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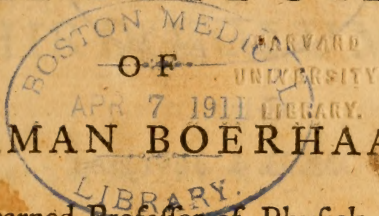
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The late Learned Professor of Physick in the
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CONCERNING

The KNOWLEDGE and CURE of the several
DISEASES incident to HUMAN BODIES.

By GERARD VAN SWIETEN, M. D.

VOL. III.

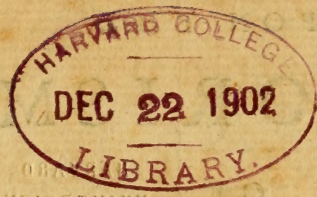
Of Wounds in the Thorax and Abdomen; Con-
tusions; Fractures; Luxations; Inflammations;
Abscesses and Fistulæ.

Translated into ENGLISH.

LONDON:

Printed for JOHN and PAUL KNAPTON, at the Crown
in Ludgate-Street. MDCCLIV.

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COMMENTARIES

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UPON THE

APHORISMS

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HERMAN BOERHAAVE,

CONCERNING THE

KNOWLEDGE and CURE of DISEASES.

Of Wounds in the THORAX.

SECT. CCXCVII.

WOUNDS inflicted in the thorax, are known to have not penetrated its cavity by inspection, by the probe, by no air being discharged by any means, by the return of liquors injected warm, by placing the body in the same posture as when it received the wound, and by certain signs that the lungs adhere to that part of the pleura which the wound has penetrated.

We call the thorax that part of the trunk of the body, which is terminated before by the sternum, behind by the twelve vertebræ of the back, on the sides by the arched ribs, above by the two superior ribs, and below by the diaphragm, which separates it from

the cavity of the abdomen. But as the diaphragm is placed obliquely, and forms a kind of arched roof, in such a manner that its fore-part rises much higher than its back-part, which is inserted lower, it is thence evident that the cavity of the thorax is much larger behind than before. Internally this whole cavity is lined on all sides with a very smooth membrane termed the *pleura*, which in a manner forms two hollow bladders, (as we explained it in § 170. numb. 4.) attached close to each other near the sternum, so as to partition the cavity of the thorax into two; and betwixt the meeting of these two *pleuræ*, is placed the pericardium with its inclosed heart, making the third chamber or cavity of the thorax.

Now in all wounds of the thorax, the first enquiry ought to be, whether they have penetrated its cavity or not? for when the wounding instrument has perforated the membrane of the *pleura*, or the pericardium, the wound may be then said to have penetrated the cavity of the thorax, otherwise not. But a wound inflicted in the thorax may be very dangerous, and injure a great many parts without entering its cavity: for the *pleura* of each side having reached the sides of the column of the *vertebræ*, recede from the ends of the ribs, and rising up leave a considerable space, which is occupied by the cellular membrane, through which the *œsophagus*, *aorta*, *thoracic duct*, &c. pass. Therefore all the parts here placed may be injured, though the wound does not penetrate into the cavity of the thorax; but this will easily appear to be very seldom the case, because these parts are defended pretty securely by the column of the *vertebræ* behind them. But that a wound has not entered the cavity of the thorax, but only injured the external parts, may be known by the following signs:

By inspection.] That is, when the wound is sufficiently large, and runs in a straight course.

By the probe.] Which being formed either of lead or soft silver, is to be introduced through the apertures

rures of the wound, without any force or violence. But it is easily apparent, that a change in the situation of the body, or the fat, concremented blood, &c. stopping up the wound, may easily obstruct the passage of the probe, and afford a resistance to the touch, notwithstanding the wound penetrates into the cavity of the thorax.

No air being discharged by any means.] It was shown in the comment on § 170. numb. 4, that the surface of the lungs is always exactly contiguous to the pleura, while the cavity of the thorax remains entire, and that no air at all is contained betwixt the lungs and the pleura; but when a wounding instrument has perforated the pleura, the air may then enter and compress that side of the lungs, and thus the space before filled by the lungs, will now be filled with external air. But this air being rarified by the heat of the parts, will in part escape through the wound, and more air will enter again; so that the air will continually enter and return by the wound, especially if the perforation of the pleura is not very large; for then the lungs may be in some degree dilated by the air entering through the glottis, as we explained it more at large in the place above cited. In wounds of the thorax therefore, a skilful surgeon always enquires whether the air rushes impetuously through the wound, and this chiefly in the following manner. After the surgeon has compressed or closed the lips of the wound together with his thumb or fingers, so that no air can enter or return by it, he then orders the patient to inspire as much air as he well can, and to retain the inspired air in his lungs, by shutting the larynx; and then, before the patient breathes out the air, he places a wax candle opposite the wound, and suddenly opens its lips; if now any air entered into the cavity of the thorax, it will be forcibly blown out through the wound, so as to move the flame of the wax candle. For thus the air entered into the cavity of the thorax by the wound, will be

rarified by the heat of the body; and the lungs of the same side being also dilated by a violent inspiration, and the inspired air rarified by its retention and closing of the glottis, this will expand the lungs, so as to increase the compressure of the air contained in the cavity of the thorax, and which will therefore rush out impetuously and with a noise, so soon as a free passage is given to it by opening the lips of the wound. Now it is evident, that if the air thus rushes through the wound, it must certainly penetrate into the cavity of the thorax; but then the thorax may be perforated, and no air be thus discharged, because by changing the posture of the body from that in which it received the wound, the fat or flesh may occlude the perforation; so that though a little air might have been admitted into the thorax, yet it cannot easily escape again for the same reason. This holds true, more especially when the wound perforating the thorax is small or narrow: and from hence we are therefore enabled to judge how far this sign may be relied upon with certainty.

By the return of warm liquors injected.] This seems to be of all the most certain and safe method of determining the question. For the search by the probe may often be fallacious, since changing the posture of the body may in a fat person occlude the perforation by the cellular membrane, which will obstruct the probe from reaching to the bottom of the wound. And sometimes the probe may enter near its whole length into the wound, without entering the cavity of the thorax; the wounding instrument having slid over the ribs into the fat, as we are taught by chirurgical observations. A student was so wounded in the right side of the thorax by a sword, in single combat, that the wound inflicted in the side as the body presented obliquely, came out on the left side of the thorax, without at all entering its cavity, because the sword slid over the ribs. Warm water is to be injected by a syringe through the mouth of the
wound

wound with a moderate force: and if a considerable quantity of water may be thus injected without any resistance or apparent tumour in the cellular membrane, we then know that the water passes by the wound into the cavity of the thorax; but if a considerable resistance is immediately felt, and the injected water returns by the mouth of the wound, this shews the contrary. Nor is any injury to be feared from this trial, even though the warm water injected should pass into the cavity of the thorax; for it may be easily discharged again from thence by a convenient posture of the body, and by the means we shall hereafter describe in § 303: or even if it is left there, it will be absorbed by the bibulous veins opening throughout the whole surface of the lungs and pleura; and that liquors contained in the cavity of the thorax may be thus carried off, we are taught by frequent experience. In an empyema, the matter has been found to be this way absorbed and discharged with the saliva, urine, or by the intestines; and the same matter entering by the veins, and mixing with the blood, has been often translated and settled upon divers other parts of the body. And thus Paré was surprized, after injecting a little liquor into the thorax to deterge and cleanse the cavity, that the wounded person should perceive an extreme bitter taste, and have an inclination to vomit^a; and therefore he abstained from his medicines.

Posture of the body, &c.] What considerable use a knowledge of the posture of the patient's body when wounded may be of, towards determining the nature of the wound, and presaging the consequent maladies to be thence feared, we have already declared in the comment on § 168. numb. 1. For frequently it is altogether impossible to discover the course of the wounding instrument betwixt the parts of the body, unless the wounded patient is placed in the same posture as when he received the wound. For the various actions of the muscles may wonder

^a Le. Oeuvres d'Ambroise Paré, Liv. X. Chapit. 32. pag. 251.

fully change the situation of the parts; as Eustachius has well expressed in his anatomical tables, in the thirtieth of which the right arm is shown elevated, and the cubitus inflected, the left arm extended with the cubitus turned downward. If now we compare the right and left side of this figure, we shall see a considerable difference in the posture of the parts.

By certain signs that the lungs adhere, &c.] Tho' the lungs, during life, always remains contiguous to the pleura, as well in expiration as inspiration, as we are assured from physiology; yet the lungs are naturally at free liberty in the cavity of the thorax, adhering to the trachea by its air-vessels, and to the heart by its blood-vessels, but in no part naturally adhering to the pleura. Now the chief cause which prevents these parts from growing to each other, seems to be a thin dew or moisture which is continually exhaled every moment of life from small arterial ducts, which open throughout the whole surface of the lungs and pleura, and prevent the concretion of one with the other. And this circumstance we find is beautifully observed by Hippocrates, with his usual brevity or conciseness of expression, when he says, ^b *Omne enim non concretum, sive cute, sive carne tegitur, cavum est, impleturque sanum quidem spiritu, infirmum vero ichore:* "For every part of the body which is not solid or grown together, but lined either with skin or flesh, is hollow in a healthy state, replenished with vapours, but in a morbid state contains ichor." But when the larger vessels are so distended in an inflammation, as to compress these small exhaling arteries, they will not then be able to discharge their thin liquor, but the dry surfaces of the inflamed membranes speedily cohere together; whence it is that we so often meet with adhesions of the lungs to the pleura after a pleurisy, peripneumony, empyema, &c. If therefore it shall appear that the wounded patient has been afflicted with these disorders, we ought then

^b Hippoc. de arte, cap. 8. Charter. Tom. II. pag. 150.

to think of this adhesion: for if the wound entered a part of the thorax where the lungs adhered to the pleura, the instrument in that case might pass a considerable length into the substance of the lungs, without perforating the cavity of the thorax. But this may be known, if the water injected by the mouth of the wound with a syringe, excites a cough, and is discharged through the wind-pipe; for in this case the wound has entered the lungs without penetrating the cavity of the thorax.

These are the signs by which it is usually determined whether the wound has injured the external parts only, or also penetrated into the cavity of the thorax. But it may sometimes happen, that all these signs, though accurately examined, may prove fallacious; especially if the wound was inflicted by a narrow instrument; for then the fat may so close up the wound after the instrument is extracted, that it will neither afford a passage to the air, probe, or injected water, and yet the wounded vessels of the lungs may extravasate their blood into the cavity of the thorax. It will therefore be necessary at the same time, to consider whether the respiration is injured; for if the cavity of the thorax be lessened either by the ingress of air or extravasated blood, the respiration will always become more difficult: and if this symptom appears after a wound inflicted in the thorax, there is some reason to suspect the wound both to be dangerous, and to have perforated the cavity of the thorax, even though no other symptoms are seen. The utmost caution is here necessary, lest the surgeon or physician should gain discredit, by supposing a dangerous or even fatal wound in this part, to be of little or no moment.

S E C T. CCXCVIII.

IF the wound (297) descends obliquely above or within the ribs, even then matter is frequently deposited in the cavity of the thorax by an erosion of the pleura; and this more especially, if the egress of the matter by the external wound is any how impeded; and thus an empyema is formed, from whence arise many bad consequences.

Though it appears evidently that the wound does not penetrate into the cavity of the thorax, yet the worst symptoms may follow thence. For if the wound descends deeply among the muscles, and its orifice lies higher, the extravasated humours will be therein collected, stagnate and corrupt so as to form various sinuses, and after eroding the pleura, it may at length pass into the cavity of the thorax: the matter having once found a vent into the thorax from the sinuous ulcer, will be daily augmenting so as to form an empyema; and the lungs thus soaking in corrupt matter, which becomes daily more acrimonious, will be themselves consumed; so that after the greatest calamities death itself will follow. The maladies we now speak of are always the worst, when a sinuous ulcer of this kind runs behind the ribs; for then there is no opportunity either to compress the parts, or dilate the wound to promote the discharge of matter. And if the boney or cartilaginous substance of the ribs and sternum are affected, many other bad consequences may again follow from thence, so as to render the cure extremely difficult; as will be more apparent, when we come to treat of diseases in the bones. In confirmation of this, we have a remarkable instance given us by Galen^a. A lad received a blow upon his sternum in

^aDe Anatom. adminstr. Lib VII. cap. 13. Chart. Tom. IV. p. 161.

Sect. 298, 299. Of Wounds in the THORAX. 9
the field of exercise; it was first neglected, and afterwards badly healed: but four months afterwards matter appeared in the part which received the blow; the physician incised the part, and soon enough brought it to cicatrise, as he thought. But a new inflammation appearing afterwards, the part was again incised; nor could the wound be now brought to cicatrification. Galen and several other physicians being called after this, found the os sternum carious, and though all of them were unwilling to undertake the cure, Galen extirpated the foul part of the sternum; and found the subjacent pericardium in part putrefied, so that he could see the heart naked; and yet the lad was cured in no long space of time. This seems to be the case also which Galen mentions in the beginning of his first book, concerning the sentences or opinions of Hippocrates and Plato, (the four first chapters of which book treat on the trunk only) where he says, he saw the heart as plainly in a lad, as when it is designedly exposed by the dissection of animals; and adds, that this lad was afterwards cured^b. But above all, these bad consequences are most to be feared, when the external discharge of the matter is impeded, either by the disposition of the wound or a perverse treatment.

S E C T. CCXCIX.

T Herefore emplaisters, compresses, and tents ought not to be used in these wounds; but on the contrary, they should be treated with soft deterging balsams, with pledgits of soft lint, and a slack bandage, assisted by a convenient posture of the body.

^b Galen. de Hippoc. & Platon. placit. Lib. I. cap. 5. Charter. Tom. V. pag. 78.

Since therefore so many and so great injuries may arise from wounds in the thorax, by the retention of humours extravasated into the cavity of the wound, where they frequently make new passages through the cellular membrane, it is therefore evident that a free discharge ought to be procured for the matter with the utmost industry. But it is a common practice with surgeons in most wounds, and especially in those of the thorax, to introduce tents for preventing the upper orifice of the wound from healing before its bottom, and to make way for the discharge of foreign bodies contained in its cavity, and also to facilitate the application of medicines down to the fundus of the wound. But the very skilful surgeon Belloste (to whom we owe the happy contrivance of perforating bones with small foramina to regenerate their periosteum, as we observed in § 252, 262.) was bold enough to oppose the torrent of this practice, and has with solid arguments demonstrated the pernicious effects of tents in wounds, and especially in those of the thorax^a: and he has likewise shown by many good instances, that practice confirms what reason had thus dictated. For tents, formed of scraped lint contorted, or other of the like substances, being inserted into the mouth of the wound, swell by absorbing the extravasated humours, insomuch that they will thus soon thrust themselves out of the wound, if they are not restrained by a plaister or bandage: but if they are confined from being thus discharged, they swell and dilate the orifice of the wound by a slow laceration of its fibres and vessels, not without extreme pain and irritation to the parts; and while they stop the orifice of the wound, they hinder the discharge of matter or other humours extravasated, which will be therefore forced to make themselves new passages, and may by that means convert the wound into a sinuous ulcer of a bad condition; or else after eroding the pleura, they may enter the cavity of the thorax,

^a Belloste Chirurgien d'Hôpital, pag. 1—43.

Sect. 299. Of Wounds in the THORAX: IY

and produce incurable mischief. Add to this, that the capacity of the thorax is continually changing every moment of life, and the ribs with their connexed muscles are perpetually in motion even in the most gentle respiration; whence such a wound would never be at rest, but continually rubbing against the sides of these tents; from whence follow pain, inflammation, and at length a callosity in the lips of the wound, which must be afterwards removed before the wound can be healed. From all which it is sufficiently evident, that no good can be expected from the use of tents in wounds of the thorax. And though they may be in some measure serviceable in dilating the mouth of a wound too much contracted, yet that may be better and more easily performed by the knife, as we said in § 238; or if a tent is required to be used for this purpose, the application of it for a day or two may be sufficient, since this does not require the use of tents during the whole time of the cure. Even a tent of sponge rightly prepared, (as we directed under the afore cited aphorisms) being introduced into the orifice of the wound, will make a considerable dilatation of it even in a few hours. For the same reason it is also evident, why the use of tenacious emplaisters is here pernicious: namely, because they impede the free discharge of humours from the wounds: The best dressings therefore for wounds of the thorax are flat pledgits of lint, spread with some vulnerary balsam or soft digestives, according to particular circumstances: over these to apply a plaister not too tenacious, but perforated with several small holes, retaining them with a convenient bandage, when necessary; being yet cautious not to compress the mouth of the wound by the compresses or bandage, so as to hinder the discharge of the extravasated humours.

Hippocrates observes, ^b *Quicumque thoracem vulnerati externa parte vulneris sanati sunt, interna non, periclitantur, ne suppurati fiant. Quibus autem debilis*

^b In Coacis Prænot. No. 430.

intus facta fuerit cicatrix, facile disrumpitur: “ That
 “ whoever; having a wound in the thorax, has the
 “ external part of the wound healed before the inter-
 “ nal, he is in danger of a suppuration or abscess inter-
 “ nally. And in those who have a weak cicatrix
 “ formed inwardly, it may be easily broke open.”
 Hence it is evident, that the greatest caution ought to
 be used to procure a consolidation of the internal parts
 of the wound, before the external orifice is closed.
 This may perhaps seem to be an argument in favour
 of the use of tents, for preventing a concretion of the
 external lips in wounds; but if it is considered that the
 tent occludes the mouth of the wound in such a man-
 ner, that the matter cannot be discharged, it will ra-
 ther appear to hinder the consolidation internally;
 since the matter confined in the wound will prevent
 the contact of the parts necessary to their union, and
 being accumulated, will form new passages betwixt the
 muscles, and by that means increase the wound inter-
 nally. But that it is contrary to the opinion of Hip-
 pocrates to stop up the mouth of such a wound with
 tents, may appear from another remarkable passage
 in the same author, which may serve to explain the
 passage last cited from his *Prænotiones Coacæ*. For
 he says, (using the same word ἐμπτῶσι, as in the last
 passage, and which is frequently used for an empye-
 ma, or collection of matter in the cavity of the
 thorax: *Quicumque à vulneribus purulenti sunt sive
 hasta, vel pugione, vel jaculo intus vulnerati sunt, quam-
 diu quidem ulcus foras respirationem habeat per antiquum
 vulnus, & hac frigidum in se attrahat, calidum vero à
 se emittat, tum pus facile, tum sane si quid aliud expur-
 gatur. Et si quidem interna et externa pars simul sanescant,
 omnino sanus evadit. Sin vero externa quidem pars
 sanescat, interna vero non, purulentus (ἐμπτῶσι) fit. At
 vero si simul tum interna tum externa pars sanata sint, ci-
 catrix autem intus debilis aspera et livida existat, quan-*

° Hippocrat. de morbis, Lib. I. cap. ix. Charter. Tom. VII.

doque refricatur ulcus, et ab hoc purulentus evadit:
 “ That whoever, being wounded internally, either by
 “ a dart, spear, or dagger, has a congestion of mat-
 “ ter from the wounds, that matter, and indeed any
 “ other foreign substance, will be easily discharged,
 “ so long as the ulcer has a communication externally
 “ by the old wound, which matter is drawn in by
 “ cold, and discharged by heat. If now the internal
 “ and external parts consolidate at the same time,
 “ the wound will be perfectly healed; but if the
 “ external parts unite without the internal, a con-
 “ gestion of matter will be formed. But even when
 “ the internal and external parts unite at the same
 “ time, if the cicatrix is internally weak, rough and
 “ livid, the ulcer will sometimes return, and a con-
 “ gestion of matter be thence formed again.”

From which passage it is sufficiently evident, that the cure ought not to be attempted by the use of tents, to procure an equal consolidation of the parts both internally and externally; but the posture of the body ought to be such, that the contained humours in the cavity of the wound may by their own weight subside to the external opening; and when the bottom of the wound is lower than its orifice, and this cannot be remedied by a convenient posture in the patient, compresses ought to be applied to the bottom of the wound, and a proper bandage used to force the contained humours to the opening of the wound; and thus the parts will readily unite internally at the bottom of the wound, when they are brought into contact by discharging the confined humours. In the mean time, the matter discharged by the external orifice, will easily prevent that from uniting before the internal parts are healed. But if the internal surface of the wound, being foul, requires to be cleansed before it can be expected to heal; then those remedies may be applied which we enumerated in § 207, and of which we shall also speak hereafter in the cure of fistulæ. The use of these remedies ought to be continued

14 Of Wounds in the THORAX. Sect. 299, 300.
tinued till the wound affords a white, smooth, viscid, uniform, inodorous and tasteless matter; and then a consolidation of the wound, now cleansed, may be attempted by an approximation of the sides by a gentle compressure, carried gradually from the bottom of the wound towards its orifice.

S E C T. CCC.

WE know that the wound penetrates into the cavity of the thorax, 1. by considering the cause and magnitude of the wound; 2. by searching with a probe, when the body is placed in the posture in which it received the wound; 3. by the patient's drawing the air forcibly into his lungs while the wound is closed, and then shutting his mouth and nose, to make the same effort as in expiration, when the air will suddenly rush through the mouth of the wound, and often form a sound or noise by its agitation in the cavity of the thorax; 4. by inspection; 5. by an emphysema; when the air contained in the cavity of the thorax being continually augmented by the action of the wounded lungs, rarified, compressed by inspiration, and its free escape through the wound prevented, by insinuating betwixt the lips of the wound, forces its way into the cellular membrane, where increasing, it often causes a soft pellucid tumour throughout the whole body, (excepting the soles of the feet, and palms of the hands) in some places to the thickness of eleven inches. See the history of the royal academy of Sciences for the year 1713. pag. 15, 18. also 4, 14. and 119, 120. where
an

an account is given of a fatal emphysema from a fracture of the ribs without a wound of the skin; 6. from the discharge of frothy blood.

Great caution is necessary in determining whether or no the wound penetrates into the cavity of the thorax; for this cavity ascends much higher before than behind, where it descends lower: from whence gross errors have been sometimes committed, in thinking a wound penetrated the thorax, when it in reality entered the cavity of the abdomen. Thus we read in Ruysch ^a, of an ignorant surgeon dwelling in some part without the city, who being desirous to perform the paracentesis of the thorax, sent for him into consultation; but Ruysch being indisposed and unable to come, the surgeon by himself perforated the thorax as he thought; but soon after a large number of hydatids forced themselves out through the wound, and the surgeon being affrighted, stopped the wound with a tent, and had recourse to Ruysch, but to no purpose, for the unhappy woman died soon after; and upon opening the body, nothing of water appeared in the thorax, but the ignorant surgeon in perforating the abdomen instead of the thorax had wounded the liver, which in that part adhered to the peritoneum, and seemed to have degenerated into hydatids, which burst forth through the wound. From whence it is evident, how well one ought to be acquainted by anatomy with the true situation and connection of the diaphragm, in order to determine any thing with certainty in these wounds.

But wounds inflicted in the cavity of the abdomen may pass into that of the thorax, by perforating the diaphragm: for discovering which there are no certain signs, and we seldom discover it but by opening the body after death; and of this we related some instances in the comment on § 170. numb. 4. But

^a Observat. Anatom. Chirurg. Centur. Observat. LXV.

wounds properly said to perforate the cavity of the thorax, of which we are now treating, are discovered by the following signs.

1. Since almost all instruments which wound with a sharp point are of a conical figure; it is evident, that the width of the wound, compared with the wounding instrument, may indicate how far the instrument has penetrated: but then this sign may deceive one, when the wound runs obliquely over the ribs among the muscles; for in that case the wounding instrument may enter to a considerable length, without penetrating the cavity of the thorax.

2. Of this we treated in § 168. numb. 1. and § 297. where it appeared that by changing the posture of the body from that in which it received the wound, the passage of the probe might be easily obstructed by the intrusion of the fat, and by the different position of the muscles.

3. Of this sign we treated in § 297. But in performing this, great care is to be taken not to let any air pass into the cavity of the thorax during the experiment; for by distracting the lips of the wound, in dilating the thorax by inspiration, it may be very possible for air to enter its cavity: For in fat people the membrana adiposa often stops up the wound penetrating the thorax, after the instrument is extracted, so that no admittance is given to the air; and therefore when this experiment is made, the lips of the wound ought to be first carefully compressed, and then the wounded patient, after having retained the air forcibly inspired, should next shut his nose and mouth, and strongly endeavour to make the effort of expiration. Thus the confined air expanded by heat will very much dilate the lungs, by which means the air lodged betwixt the lungs and pleura will be compressed, and likewise rarified at the same time by the warmth of the parts; the wound being now opened, there will be no danger of the external air entering through it into the cavity of the thorax, because the
lungs

lungs greatly expanded will be applied close to the sides of the pleura, if no air is as yet contained in the thorax; but if any air has already entered its cavity, it will overcome the pressure of the atmosphere, by its rarification from the warmth, and compressure by the expansion of the lungs, so that it will rush out forcibly through the wound. But if the wound was such or so large as to admit a very free ingress of the air into the cavity of the thorax, and yet not so large as to much exceed the aperture of the glottis, (*vide* § 170. num. 4.) in that case the air will enter into and return out of the cavity of the thorax by the wound with a very manifest noise; and then there is not the least room to doubt of its penetrating.

4. Of this sign we treated in § 297.

5. We took notice of this wonderful symptom before, in § 244, so far as it sometimes attends wounds of the head: but it is much more frequently an attendant on wounds of the thorax penetrating its cavity, in which this surprizing kind of tumour may be spread in a little time throughout the whole body. For the air having entered into the cavity of the thorax through the wound, whose external orifice is at the same time closed by the fat, sticking plaisters, or other dressings; this confined and rarified air often forces itself a way into the cellular membrane, or spreads through the panniculus adiposus. But more especially very large tumors of this kind arise, when the air-vessels of the lungs are injured by the wound, so as to deposite their inspired air into the cavity of the thorax; for in that case the malady increases every moment. Parey gives us a wonderful case, resulting from this cause which we before related from him in the comment on § 249. In this case the wind-pipe appeared to be wounded in the neck, and the air escaping from the wound insinuated into the cellular membrane or panniculus adiposus, and so surprizingly tumified the face, that neither eyes nor nose could be discerned. And when the wounded patient was given

over by others, a skilful surgeon by making deep scarifications into the panniculus adiposus, discharged the included flatus, and in a manner recovered the patient from the jaws of death^b. A wonderful emphysema following a wound of the thorax, penetrating the substance of the lungs, is described in the memoirs of the royal academy of sciences at Paris^c. A man thirty years old, of a sanguine and fleshy habit, received a wound penetrating the cavity of his thorax, of which he expired on the fifth day. But before death his whole body was surprizingly swelled with an emphysema, excepting the soles of his feet, palms of his hands, and the vertex of his head. Upon the thorax this tumour was eleven inches thick; upon the abdomen, nine; in the neck six, and in the other parts of the body it was four inches. The eyes in this dead body were in a great measure thrust out of their orbits, from the cellular membrane being distended with a great quantity of air. There is still another extraordinary case of this kind mentioned in the same book^d, of a fatal emphysema arising from a fracture of the ribs, the skin remaining entire. A man sixty years old had the fourth and fifth of his true ribs broke in the middle of the left side, by some wheels passing over his breast: soon after a considerable swelling appeared in the affected side, from the entrance of the air into the panniculus adiposus; which tumour increased daily, with a difficulty of respiration, till on the fourth day after the accident the man expired. In this body an emphysema appeared all over its surface, except the palms of the hands and soles of the feet. Upon dividing the skin and the rest of the integuments which covered the broken ribs, a small and scarce perceptible aperture was found thro' the intercostal muscles, without any ecchymosis; and upon opening the thorax, a small laceration was

^b Les Oeuvres d'Ambroise Paré, Liv. X. Chapit. 30. pag. 249.

^c Acad. des Sciences, Pan. 1713. Mem. p. 5, &c.

^d Ibid. Mem. pag. 154, &c.

observed in the external membrane which invests the lungs, part of the membrane adhering yet to the lungs, and part to the broken rib; but no extravasated blood was found in the cavity of the thorax.

From hence it is sufficiently evident, that emphysematous swellings frequently arise from wounds in the thorax; especially when the wound admits air into the cavity of the thorax, while at the same time it is by any cause prevented from escaping again through the orifice of the wound. But these observations teach us, that the very largest of these emphysematous tumours will be produced, if the lungs are also injured so as to transmit their air into the cavity of the thorax; especially when there is no considerable hæmorrhage at the same time: for the blood filling the cavity of the thorax, would prevent so large a quantity of air from being accumulated in the cavity, sufficient to inflate the cellular membrane of the whole body. Hence the reason is also evident, why one may justly conclude the wound has penetrated the cavity of the breast, when one of these emphysematous swellings appear soon after a wound inflicted in the thorax.

6. This sign certainly denotes the lungs to be injured: for in that case the blood, flowing from the wounded blood-vessels into the air-vessels of the lungs, by mixing with the air it will become frothy; and therefore frothy blood will be coughed up from the wind-pipe, or else the same blood will run in a stream from the external wound. But the lungs cannot be injured, unless the wounding instrument shall have penetrated into the cavity of the thorax; except the lungs should happen to adhere to the pleura in the part wounded, of which we treated in § 297. * Virgil has beautifully expressed this circumstance, where he describes Antiphaten to be wounded by Turnus.

* *Æneid*, Lib. IX. vers. 700, &c.

Volat Itala cornus

Aera per tenerum, stomachoque infixā sub altum

Pectus abit : reddit specus atri vulneris undam

Spumantem, & fixo ferrum in pulmone tepescit.

For the same reason if frothy blood is spit in diseases, it is supposed to come from the lungs.

S E C T. CCCI.

THE effects or consequences of such a wound are frequently, 1. a pressure of the air, which has entered the thorax, upon the surface of the lungs, by which means they are indisposed both for respiration and for circulating the blood; 2. an extravasation and accumulation of blood within the cavity of the thorax; 3. a putrefaction of the juices which are extravasated, heated, agitated, and confined on all sides; 4. Hence a maceration, erosion, corruption, and fætor of the pleura, lungs, mediastinum, diaphragm, and pericardium; 5. an infinite number of disorders arising from these last; 6. spitting of blood.

We have here enumerated the disorders or accidents which have been sometimes observed to follow wounds penetrating into the cavity of the thorax; all which result either from the admission of the air, or the extravasation of the juices.

1. It was before demonstrated in the comment on § 170. numb. 4. that naturally there is never any air, in a healthy person, betwixt the lungs and the pleura; and that this was necessarily required, in order that the lungs might be distended wth air rushing through the glottis, by the dilatation of the thorax. Whence it follows, that so soon as the air is admitted by a wound, into the cavity of the thorax, it will
evi-

evidently impede the free expansion of the lungs, or even totally prevent their expansion, if the wound is large. In the place here cited, we made it evident from various experiments, how far, and under what restrictions, this assertion is true. For if the air has a very free passage through the wound, the lungs cannot be dilated; but if a smaller quantity of air enters through a narrow wound than can enter through the open rimma of the glottis, the lungs will then be in some measure expanded, though not to such a degree as they ought in a state of health. This is a thing very well expressed by Galen^a, when he says, *Notum vero est, inspiratione per animantis os facta, tantum necessario perire ob vulnus, quantum ejus loco extrinsecus influit circumflui aeris in thoracem. Quanto autem minus inspiraverit per os ad necessitatem, tanto etiam minus efflari; quanto autem efflatio decreverit, tanto vocem sequi breviorē necesse est:* “ It is a thing well known, “ that the inspiration made by the mouth of an ani- “ mal must necessarily be diminished by a wound, in “ proportion to the quantity of ambient air that “ flows into the cavity of the thorax. But of neces- “ sity less air must be expired, in proportion as less “ was inspired by the mouth; but as much as the ex- “ piration is lessened, so much must the voice become “ shorter from thence of necessity.” If now the air which has entered the cavity of the thorax is from any cause confined, or prevented from escaping again through the orifice of the wound, it will be rarified or expanded by the heat, and by strongly compressing the lungs, obstruct the inspiration and the dilatation of the lungs thence following: and which is required in the animal after birth, that the blood expelled by the right ventricle may pass freely through the narrow extremities of the pulmonary artery. But the rational of all these may easily be deduced from the known properties of the air, and from those requisites which

^a De Anatom. administrat. Lib. VIII. cap. 3. Charter. Tom. IV. pag. 172.

demonstrated from physiology to be necessary for the performance of respiration, and for the free circulation of the blood through the vessels of the lungs.

2. If for example the intercostal arteries were wounded, the extravasated blood may be collected to a considerable quantity within the cavity of the thorax; for the adjacent heart drives the blood with a great force into these arteries; and the motion of the thorax in respiration prevents the injured arteries from resting and closing so soon as they otherwise might. If at the same time the blood vessels of the lungs are also wounded, it is very evident that a large quantity of blood must be suddenly accumulated; but if the largest blood vessels passing out from the heart are injured, death soon follows. But if the blood thus extravasated is not discharged by the external aperture of the wound, it will be collected in the cavity of the thorax, and hinder the free dilatation of the lungs, whence extreme anguish and difficulty of respiration.

3. The blood thus extravasated and confined in a warm and moist place, and continually agitated in respiration, will therefore very easily degenerate and acquire a corrupt or putrid state, especially when the air has almost continually access through the wound, penetrating into the cavity of the thorax; as also when the air is admitted into the cavity of the thorax in inspiration, by a wound in the air vessels of the lungs. The observations which have been made in surgery teach us, that this extravasated blood will putrefy in a very short space of time. In our commentaries on § 172. numb. 3. where we treated of these disorders, we related the case of a soldier who was wounded in the thorax in such a manner, that he discharged blood by coughing from the mouth, and the ignorant surgeon so united the lips of the wound by sutures, that nothing could discharge itself. Parey being called in on the next day, immediately cut open the suture, and with his finger removed the thrombus of congealed blood, which obstructed the orifice

of the wound, and extracted eight ounces of blood from the cavity of the thorax, already fetid and corrupted. In a nobleman, who had received a wound from the thrust of a sword penetrating the cavity of the thorax, after the loss of seven or eight pounds of blood, Belloste^b extracted six or seven ounces of blood already half corrupted, upon removing the dressings, towards the end of the day in which the wound was received. And Hippocrates tells us^c; *Quodsi sanguis ex vulnere aut vena fluxerit in superiorem ventrem, necesse est illud pus fieri*; "That if blood runs from a wound or blood vessel into the thorax, it will of necessity turn into matter." But it was demonstrated before in the commentaries on § 172. numb. 1. where we cited a like passage from his aphorisms, that by this term of suppuration he understands any kind of corruption of the blood whatever; as Galen has observed in his explanation of that aphorism.

4. The putrefaction so soon formed in the extravasated blood, will be every moment increasing; for there is here a very considerable heat from the vital viscera adjacent; from whence the blood will be converted into a putrid mass. The lungs lodging in this corroding and putrid liquor will themselves be macerated and putrefied; and the like will also happen to the pericardium, pleura, &c. It appeared in the preceding paragraph, that the blood extravasated into the cavity of the thorax may very speedily corrupt; and that it may there acquire the highest degree of putrefaction we are taught by observations. In a man who was wounded in the back, so that the sword entered the cavity of the thorax and penetrated the left breast, after the most malignant and pressing symptoms, the paracentesis of the thorax was performed; and on the sixth day after the infliction of the wound a very considerable quantity of matter was discharged, but so fetid that no one dared to stay in the chamber

^b Le Chirurgicalien d'Hôpital, pag. 93. circa finem. Charter. Tom. VII. pag. 533.

^c De morbis, cap. 2.

where the patient lay ^d. In another patient, after the third day from the reception of the wound, which Scultetus dilated, near a pound of blood discharged itself from the cavity of the thorax, but of so hot a nature, that it seemed to burn the patient as it ran out more than a flaming candle ^e. It is therefore no wonder that the substance of the viscera may be consumed and eroded by macerating in such a putrefied mass of humours, and which as we read in Hildanus ^f has produced the same effect on the compact substance even of the heart itself. A countryman employed in carrying of damp hay, received from thence an injury to his destruction; he felt a sense of pain with a kind of oppression at his heart, and complained of a difficulty in breathing; but four days afterwards he returned to his labour. But some days more being elapsed, he was taken with a burning fever, asthma, delirium, watchings, faintings, &c. and expired on the eleventh day of the disease. In opening the body the pericardium was found replete with a foul matter, in which the heart, appearing to be in a manner surrounded, was found eroded or dissolved for a considerable space, towards the each auricle chiefly; and the lungs appeared to partake of the same disorder.

5. The extravasated humours may by their compressure or putrid and eroding acrimony disturb or abolish all the functions of those viscera which are placed in the thorax. Hence a dyspnoea of the worst kind, violent palpitations of the heart, intolerable anxieties, inflammations, ulcerations, gangrene, &c. may follow in these parts. But the extravasated blood putrefying and becoming attenuated by the heat of the parts, and by stagnation, may be absorbed by the bibulous veins seated in the surface of these parts, and mixing with the blood may produce a putrid ca-

^d Scultet. Armament. Chirurg. Observ. 43. pag. 255.

^e Ibid. Observ. 50. pag. 262.

^f Observat. Chirurg. Centur. 2. Observat. 27. pag. 106.

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cochymy of the worst kind: from hence follow putrid and acute fevers, translations of the absorbed putrid matter to other parts of the body, a phthisis, atrophe, and death. From all which it is justly concluded, that an infinite number of the very worst diseases may arise from humours extravasated within the cavity of the thorax.

6. If blood be spit up immediately after the infliction of the wound, it is a sign that the lungs are injured, especially if it appears frothy: and therefore in that case blood may escape into the cavity of the thorax from the wounded vessels of the lungs, unless perhaps the lungs should adhere to the pleura in that part where the wound was received. If blood is spit up some days after the wound was received, that may proceed from the extravasated blood being attenuated by heat and rest, and re-absorbed by the vessels of the lungs. In what manner this is done I shall not dispute; but certain it is, that even an empyema has been cured by a purulent spitting. In a true pleurisy, the spitting of a yellow matter mixed with streaks of blood often terminates the disease, as we are assured from innumerable practical observations. All this proves the possibility there is for the extravasated blood within the cavity of the thorax to cause a bloody spitting.

S E C T. CCCII.

THE signs of blood extravasated within the cavity of the thorax are, 1. an orthopnoea, or such a difficulty in respiration, that the patient is obliged to breathe erect. 2. The patient's lying easiest on his back, it being very uneasy for him to lie on the wounded side, and impossible for him to lie on the sound side. 3. The consequences described before in (301). 4. A weight or heaviness on the diaphragm. 5. A fluctuation of

of the matter. 6. The nature and situation of the inflicted wound. 7. Great weakness, with paleness and cold sweats. 8. A constant increase of almost all the symptoms.

After it has appeared evidently, that the wound has penetrated the cavity of the thorax, another question of great importance must then be asked; namely, whether the divided vessels have extravasated any considerable quantity of blood within the cavity of the thorax? And this cannot always be easily determined, since many of the signs which we shall hereafter enumerate may prove fallacious; and therefore the concurrence of several of these signs is required in order to determine any thing with certainty in this matter. But it may be evidently of the worst consequence for a physician or surgeon to be mistaken in his diagnosis here, since the extravasated blood ought to be discharged either by the wound or by making a new apertion: but if the thorax be thus perforated, while no blood is confined in its cavity, it will admit the air, which is always pernicious here, and the wound will be therefore irritated, &c. whence it follows, that one ought to attend to every circumstance with the greatest caution, lest the patient should suffer by an operation without necessity, or the surgeon be injured in his reputation.

I. An orthopnoea is said to be a short, difficult, and noisy respiration, which the patient can perform only with his neck and breast erect; and which always denotes, that the free expansion of the lungs by the inspired air is impeded from some cause. But since the blood extravasated within the cavity of the thorax occupies the space that the dilated lungs ought to fill, it is therefore very evident, that this may cause a difficult respiration. But while the patient holds his body in an erect posture, the extravasated blood pressing by its weight on the diaphragm will augment the

the cavity of the thorax, by which means the lungs may then receive a somewhat farther expansion; or at least they may be dilated more in that posture of the body than in any other. Yet if this sign be attended to alone, it may deceive one: for the air, which entered the cavity of the thorax by the wound, may impede the free expansion of the lungs and cause an orthopnoea. A spasmodic constriction of the lungs in asthmatic people produces the like disorder; so that if the patient wounded should have been subject to an asthma, this will be no very certain sign.

2. This is a sign of very great moment. For the diaphragm descending or being continued lower on the back part of the body, much increases the capacity of the thorax; so that the blood extravasated within the capacity of the thorax will naturally subside to the lower and back part of the thorax, when the patient lies down; and the back part of the diaphragm will descend more easily, for the middle of it is tendinous, to which the broad basis of the pericardium is attached, and therefore cannot easily be depressed, as we said before in the commentary on § 170. numb. 4. from whence it is evident, that the extravasated blood will be lodged easier in this posture than in any other. But when the patient lies on the injured side, the posture of the body will be more painful, though tolerable; but if the patient lies on the sound side, the weight of the extravasated blood will press the mediastinum and pericardium towards the other side of the thorax, whence its capacity will be diminished, and the difficulty in respiration increased; which the patient in this posture no sooner perceives, but he immediately changes it or turns himself, even against his inclination, to avoid suffocation.

3. These consequences result chiefly from the putrefaction of the extravasated blood, and the morbid impression on the viscera, which is made by such a putrid mass: so that from these we may indeed discover

ver the existence of extravasated juices, but this frequently too late.

4. While the patient is fixed in an erect posture, the whole weight of the extravasated blood presses the diaphragm downwards: therefore at that time the patient perceives the sense of an incumbent weight, with a pain about those parts to which the diaphragm is connected. Frequently also a tumour appears in that side of the abdomen where the diaphragm is depressed; insomuch that sometimes, in an empyema, the diaphragm is so much depressed, and gradually extended by the quantity of the confined matter, that it causes the abdomen to protuberate in the manner of an ascites.

5. Where there is any suspicion of confined matter within the cavity of the thorax. Hippocrates^a orders the patient to be seated in a fixed chair after the plentiful use of warm bathing; and while somebody holds his hands, the physician must endeavour to discern on which side the noise or fluctuation is made while the shoulder is shook. And the same method he takes to discover a latent dropsy in the cavity of the thorax^b, and to determine the place, by opening which the serum collected in the thorax may be discharged. But it is easily apparent, that this sign may sometimes deceive one, for while the extravasated blood is collecting in the cavity of the thorax, it congeals by stagnating, and therefore renders its fluctuation very difficult to be perceived; also if the thorax is filled with a large quantity of blood, no sound or noise will be heard upon shaking the body, by reason of the fulness; and therefore it is a prudent admonition of Hippocrates^c, when he says, *Quibus suppuratis, dum concutiuntur humeri, multus strepitus fit, minus puris habent, quam quibus, difficiliter spirantibus*

^a De morbis, Lib. II. cap. 16. Charter. Tom. VII. pag. 568.

^b Ibid. cap. 24. pag. 576. & De internis affectionibus, cap. 24. Ibid. pag. 656.

^c In Coacis Prænot. n°. 432. Charter. Tom. VIII. pag. 877.

Et melius coloratis, exiguus. Quibus autem strepitus nullus fit, valida tamen spirandi difficultas adest, Et ungues lividi, pleni sunt pure, Et perniciose habent; “ In those empyemas, where a great fluctuation is heard upon shaking the patient’s shoulders, there is less matter, than where the sound is weak in those who breathe more difficultly, and are better coloured. But in those who have no fluctuation, and are yet attended with a very difficult respiration and livid nails, these are full of matter and in a deplorable state.”

6. For when we know the seat of the wound and the course of the wounding instrument through the parts, we can then tell from anatomy whether or no any large artery or vein is injured. Thus the larger trunks of the intercostal arteries run near the lower margin of the ribs; those of the internal mamillary are placed near each side of the sternum, at about the distance of a finger’s breadth from that bone, behind the cartilages of the ribs. The large vena azygos is seated on the right side of the vertebræ of the back, &c. from a thorough knowledge of all which the wound is concluded to be more or less dangerous.

7. There are some men so pusillanimous, that they will fall down into a deliquium at the sight of the wounds of others; and in such, all these symptoms may happen, though they are but slightly wounded. But in such a case they easily recover themselves by the aspersion of cold water, or the exhibition of a stimulating cardiac; nor does the weakness continue long which thence arises. But when, after the infliction of a wound penetrating the cavity of the thorax, there directly follows great weakness, a contraction and paleness of the face, a languid pale look of the eyes, a cold sweat gathering in drops upon the skin, especially upon the face and breast, and the pulse is found scarce discernible; we then know, that by the wound of the vessels so large a quantity of blood is extravasated, that scarce any returns to the heart, but that

that the whole mass is either discharged from the wound externally, or else collected within the cavity of the thorax. In such a case therefore the most imminent danger ought to be declared to be at hand; for they suddenly expire. This has been well observed by Hippocrates^d, where he says, *Sanguinem profundia cum sudatiunculis vulnera maligna. Tales enim loquentes occulte pereunt*: “That wounds which have an hæmorrhage attended with sweats are malignant: “for such patients expire secretly while they are “speaking.” In his^e *Prænotiones Coacæ* there is also the same sentence; only we there read, $\epsilon\phi\delta\epsilon\sigma\iota\lambda\alpha$ for $\epsilon\pi\iota\pi\pi\gamma\epsilon\upsilon\iota\lambda\alpha$, rigors instead of sweats; but he elsewhere observes^f, that rigors follow large hæmorrhages; and says, that the rigor stops the flux of the blood: but then it is evident from what went before, that in this place he speaks of a bleeding at the nose. But when large vessels near the heart have been injured by a wound penetrating the thorax, it is very evident that a rigor may here follow a large hæmorrhage, without producing any stoppage of the flux of blood.

8. The blood-vessels here are very large, and very near the heart: and therefore the blood continues to flow from them into the cavity of the thorax, whence a pressure upon the lungs, anxieties, difficulty of breathing, &c. which increase every moment till the hæmorrhage ceases, either from a contraction of the divided vessels, or from a weakening of the patient's vital forces. Many symptoms may also follow in the patient thus wounded, from the fear, anger, or the like, which accompanies, and which gradually vanish; but those symptoms which result from the hæmorrhage continue as that continues; and therefore a continual increase of the symptoms is always justly reckoned among the signs, by which we know that blood is extravasated within the cavity of the thorax.

^d Prorrh. Lib. I. num. 130. Charter. Tom. VIII. pag. 791.

^e N^o 328. Charter. ibid. pag. 870.

^f Prorrh. Lib. I. num. 152. Charter. ibid. pag. 799.

But when a wound penetrates any of the larger cavities of the body, and the signs denote that there is room to fear that the divided vessels extravasated their blood in full stream inwardly, though no hæmorrhage appears externally; in such a case the prognosis ought to be made with caution, lest the reputation of the physician or surgeon should be risked, if they pronounced no danger: for frequently the patient thus wounded expires unexpectedly, and the death of the wounded patient is imputed to their ignorance, by those who plead the cause of the wounder. But how carefully one ought to attend to all the appearances, in order to determine rightly whether or no any extravasated blood is lodged in the thorax, is evident, inasmuch as the most skilful are sometimes deceived herein. The celebrated M. Mery § ingenuously confesses, that in a young man who was wounded with a sword in the anterior and upper part of his right arm, within three hours after the wound was inflicted, he observed so many and so great symptoms, that he made no doubt but that the cavity of the thorax was full of extravasated blood, and therefore began seriously to think of making the paracentesis of the thorax. But the event afterwards taught that the case was otherwise, the patient being perfectly cured of his wound within the space of eight days. But it seemed highly probable, that the tendon of the pectoral muscle being injured, occasioned the severe pain of the breast, great difficulty of respiration, &c.

S E C T. CCCIII.

THE extravasated blood ought to be immediately extracted, 1. by a convenient posture, motion and straining of the body; 2. by sucking through a flexible tube, having holes in its sides, and obtuse at the end; 3. by injecting

§ Academ. des Sciences l'an. 1713. Memoires, pag. 159.

some

nerve
Dr Hunter
Baron Haller have
found that the Ten-
ons are insensible
D. J.

some diluent, attenuating and deterging liquor: 4. by dilating the wound; or 5. by making another opening betwixt the second and third of the lower true ribs, at the distance of four fingers breadth from the vertebræ, and as much from the lower angle of the scapula, making your incision with a knife, parallel to the ribs, betwixt the middle of them, and directing the edge downwards.

After it has appeared from the signs enumerated in the preceding paragraph, that extravasated blood is lodged in the thorax, the curative indication then directs to immediately remove or extract it, lest it prove injurious by its pressure or putrefaction; and yet at the same time it ought to be particularly remarked, that this extravasated blood should not be discharged before it appears that the injured vessels have done bleeding. For of what service can it be to discharge the blood, if by the motion of the body, sucking, injections, or the like, the wounded vessels yet open are so irritated, as to continue bleeding. When the pulse appears sufficiently strong and equal, the extreme parts of the body feel warm, no hiccup or convulsion appears, and the patient's strength continues, we then know that the internal hæmorrhage has ceased, and that the artifices required for discharging the blood from the cavity of the thorax, may be then safely used.

But it may be doubted whether the extravasated blood ought always to be discharged by art, since it is apparent from the most faithful observations, that blood, matter, water, &c. has gradually vanished from the cavity of the thorax, and being absorbed by the veins, has been afterwards discharged by sweat, urine, &c. Such a case is related by *Fabricius ab Aquapendente*^a. A friend of his received a wound in

^a Opera Chirurg. part. 1. Lib. II. cap. 22. pag. 214.

the thorax penetrating into its cavity, but so small, that it could not be discovered to penetrate even by the probe; which yet appeared from the spitting of blood, the sense of a weight pressing on the diaphragm, a cough, fever, obstructed respiration, &c. But since nothing could be extracted by the wound, the physicians concluded to make the paracentesis of the thorax on the day following. In the mean time it happened, that the patient discharged a pot full of blood by urine, which relieved him from the pain, fever, and all the other symptoms. Another case of the same nature is to be found in Belloste ^b. A captain received a wound penetrating the cavity of the thorax, and entering the lungs, and all the symptoms appeared which usually attend such wounds. When a vein was opened, instead of blood real matter was discharged to the relief of all the bad symptoms. Our author testifies, that this case was told him by a very expert surgeon, and confirmed to him by several eyewitnesses of incontestible credit. A copious discharge by urine, or a plentiful sweat, has been often observed of services in the like cases, by the same author ^c: And there are many more of the like observations to be met with; but these are sufficient to prove, that nature, who so frequently assists herself, often cures such wounds by extraordinary ways. But this does but rarely happen; and it is the part of a prudent physician to attend diligently whether the signs denote that nature is about to make such an attempt: but in the mean time, if we were to trust to nature only in these cases, it is certain that many would perish, from a destruction of the vital viscera by the extravasated and putrid blood, who by an artificial extraction of the same blood, might have been saved. This extraction therefore is to be attempted by the following means:

^b Chirurgien d'Hôpital, pag. 265.

^c Ibid. pag. 94, 95.

1. If the blood lodged in the cavity of the thorax is as yet fluid, and the wound being sufficiently large does not run obliquely thro' the integuments, but directly penetrates into the cavity; in this case, if the patient be placed in a convenient posture, the blood may descend by its own weight to the mouth of the wound, and discharge itself without other assistance. Therefore in such a case the most skilful surgeons apply nothing to the orifice of the wound for some hours, that the blood may have a free exit. Thus Dionis^d treated a man wounded into the thorax under the right breast. For when he found the cavity of the thorax full of blood, he first dilated the orifice of the wound, and then ordered the patient to lie all night on the wound, so that on the next morning he found the cavity of the thorax quite void of any blood, and the wounded patient was happily cured. Parey^e ordered a man, who was wounded in the same manner, to be placed with his feet upwards, and his head downwards, and then introducing his fingers into the orifice of the wound, he removed the thrombus of congealed blood, extracted that which was extravasated, and delivered the patient from imminent danger of suffocation.

This method of discharging the extravasated blood from the mouth of the wound, is by a compressure of the abdomen either by the hands or by a broad roller, the patient at the same time retaining the inspired air as long as possible, and then making the effort of expiration, while the glottis is closed; for thus the lungs being extremely dilated, and the diaphragm pressed upwards, the blood extravasated into the cavity of the thorax, will be pressed out through the mouth of the wound.

2. Since it is often very inconvenient in many wounds of the thorax to keep the patient in such a

^d Operations de Chirurg. pag. 295, 296.

^e Liv. X. Chap. 32. pag. 251.

posture,

posture, as that the extravasated blood may discharge itself by its own weight through the opening of the wound: therefore another method has been contrived; namely, the introduction of a^f flexible pipe, of gold, perforated in the sides with many apertures, and furnished with a golden probe filling its cavity (which is to fit it for bending without diminishing or spoiling its cavity) which is to be carefully passed thro' the mouth of the wound, as low as possible into the cavity of the thorax; and then by sucking, or by the application of a syringe, they evacuate the extravasated blood. The apex or end of this tube is required to be obtuse, to prevent it from injuring the lungs. A tube of the same form, and for the same use, may be made of lead; as also of flexible leather and whale-bone. With such an instrument inflected like a siphon or crain, being introduced, and then drawing out the probe, ^g Scultetus extracted a large quantity of extravasated blood from the cavity of the thorax, without making any suction.

3. It is easily apparent, that the two preceding methods take place only when the extravasated blood is fluid; for if it has concreted into grumes, it will not easily escape through the mouth of the wound, much less will it enter the small orifices of the introduced tube. It is indeed true, that congealed blood spontaneously dissolves itself in time, but then it also putrefies, which is here very prejudicial to the patient: and frequently the anguish from the compression of the lungs is so great, that one cannot possibly wait for this spontaneous dissolution of the congealed blood. In this case therefore we inject into the cavity of the thorax warm water, with the addition of some honey, venice soap, and a little salt, (as we directed in the comment on § 236); this liquor being afterwards agitated by the motion of re-

^f Scultet. Armament. Chirurg. Tab. XII. fig. 9 & 10.

^g Ibid. Observ. 42. pag. 248.

piration, is in a manner blended with the concreted grumes, which are by this means dissolved, so as to be capable of passing out with the injected liquor through the mouth of the wound. The injection is to be rendered medicinal, with different ingredients, according as different circumstances may require. For diluting and dissolving the concreted blood, warm water will be sufficient, mixed with a little honey and salt; but when the extravasated blood has already begun to putrefy, it will be convenient to use an infusion of scordium, rue, horehound, and the like gentle deterging and antiseptic ingredients.

4. Of this we treated before at § 238.

5. When the wound is of such a nature, that it is impossible to discharge through it the liquors contained in the thorax, there is then no method left but to make a new opening in a part of the thorax, to which the confined juices have a natural tendency, from the internal figure of its cavity. This method is more especially necessary, when the wound is inflicted in the upper part of the thorax; for then it is scarce possible for the extravasated blood to pass out through the orifice of the wound. But since the cavity of the thorax descends deepest towards the back, from the inclined posture of the diaphragm, therefore the thorax is to be perforated in its back part, as low as can possibly be done without danger of injuring the diaphragm, which is attached to the lower ribs, and by ascending forwards from the posterior part of the thorax, forms with the bodies of the vertebræ a pretty acute angle. But to avoid injuring the strong muscles termed *sacro-lumbalis*, *longissimus dorsi*, &c. which ascend through the loins and back on each side the *spina dorsi*; therefore the opening ought to be made at the distance of four fingers breadth at least from the vertebræ. The opening is most usually made betwixt the second and third, or betwixt the third and fourth of the spurious ribs, reckoning from below upwards.

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upwards. But since it appears from anatomy ^h, that the diaphragm ascends higher in the right side of the thorax, therefore when the paracentesis of the thorax is made on the right side, it is usually performed betwixt the third and fourth rib: but when on the left side, betwixt the second and third of the spurious ribs, as *Van Solingen* ⁱ has observed. Perhaps it is for this reason that Hippocrates ^k, enquiring which side of the thorax ought to be perforated in the empyema, wished the matter to be lodged in the left side. Dionis ^l also directs to make the opening betwixt the third and fourth rib. Hence an error seems to have crept into the text of this aphorism, when it directs the place for incision to be between the second and third of the true ribs, since in a passage that follows afterwards, the place is directed to be much lower; and in § 1191. numb. 3. treating of the paracentesis of the thorax in the cure of an empyema, the place is directed to be betwixt the fourth and fifth, or fifth and sixth ribs, counting upwards; which is the place that ^m *Ægineta* observes to have been perforated by some in the cure of an empyema, though he presages either sudden death, or an incurable fistula from the operation. I therefore believe that the text ought to be read, *betwixt the second and third of the lower spurious ribs*: unless you will here understand the perforation to be made in the anterior part of the thorax, which may then be certainly the best made betwixt the second and third of the true ribs, counting upwards, as ⁿ Dionis directs, who only mentions one advantage from making the paracentesis in this part, namely, that the patient can dress his own wound in the absence of the surgeon. But the greater profun-

^h B. Siegfr. Albini Histor. Musculorum hominis, Lib. III. cap.

81. pag. 300.

ⁱ Manuale Operatiën, &c. tweede deel, cap. 1. pag. 118.

^k Hippoc. de Morbis, Lib. II. c. 16. Charter. Tom. VII. p. 568.

^l Dionis Cours d'Operations de Chirurgie, Demonst. 5. p. 296.

^m *Æginet*. Lib. VI. cap. 44.

ⁿ Cours d'Operations de Chirurgie, &c. pag. 296.

dity of the thorax backwards, and the natural tendency of the blood towards a low aperture, when the patient is in a supine posture, rather persuade us to prefer the perforation of the thorax in its posterior and lower part. Hippocrates^o, in treating of the cure of an empyema, though he does not directly point out the place to be incised, does yet determine it to be made in the lowest and back part of the thorax. For he says: *At si præ crassitudine & copia (puris) nullum strepitum ediderit, quo illud deprehendatur (sit enim hoc aliquando) utrumlibet latus intumuerit, ac magis doluerit, illud infima parte secare (oportet) à posteriori magis tumoris parte, quam ab anteriori, ut facilis tibi sit puris effluxus. Secare vero inter costas, &c.* “ If the matter
 “ should from its thickness and great quantity yield
 “ no fluctuating noise, whereby it may be discovered,
 “ as is sometimes the case; which ever side is tumefied
 “ and most painful, there a perforation ought
 “ to be made, rather in the lowest and most backward
 “ part of the tumour, then more forward, that
 “ you may have a more easy discharge of the matter.
 “ But to cut betwixt the ribs, &c.” And again, speaking of the same disease, he says, *Secare aut urere oportet quam proxime ad septum transversum, cavendo tamen ipsum septum;* “ You ought to make
 “ your incision, or apply your caustic as near as possible
 “ to the diaphragm, taking care to avoid that
 “ itself,” *i. e.* not to injure it.

In a dropsy of the thorax, where the water is to be extracted, Hippocrates^a directs to incise down to the bone from the last to the third rib, and then to perforate with a sharp terebra, and after the perforation is made, he orders the water to be extracted by a little at a time, &c. From whence it is sufficiently evident, that Hippocrates chose the lowest part of the

^o De Morbis, Lib. II. cap. 16. Charter. Tom. VII. p. 568.

^p Ibid. Lib. III. cap. penultimo, pag. 593.

^a De internis affection. cap. 24. Charter. Tom. VII. pag. 656.

thorax, in order to extract the contained humours by perforating it.

The place being thus determined, may be easily found by counting the ribs, when the patient's body is unclothed: but when the patient is fat, or when an emphysema attends, this may be more difficult to discover; and therefore surgeons have endeavoured to determine the part for incision by another method. They draw a string straight from the ensiform cartilage to the *spina dorsæ*, and then divide the said string into three equal parts, and then they determine the place to be two thirds of the length of the string distant from the sternum^r. Dionis^s measures the distance of four fingers breadth from the lower angle of the scapula, and at the like distance from the *spina dorsæ* he marks the place to be incised. But since the scapula is moveable, and may change its place by the different actions of the muscles attached to it, it is evident that this method cannot be always very certain. It will be therefore best to examine the part thus pointed out by the fingers, to see whether it falls upon the interval betwixt the ribs.

When the part to be incised is thus known, it is usually marked with ink, that it may not be lost again: But as the ribs are moveable, 'tis very evident, that an alteration in the posture of the body will also change the situation of the skin. Therefore Hippocrates^t justly cautions, *Quum vero secare aut urere voles, nota impressa, fac ut eandem figuram servent inter secandam, aut urendam, ne fallat cutis figure mutatione sursum vel deorsum vergens*: " That when
 " you would either incise or cauterise, making a mark
 " of distinction, cause the parts to keep the same
 " posture during the incision or cauterisation, that the
 " figure of the skin may not deceive you by its shifting
 " upwards or downwards." The opening ought

^r Van Solingen Manuale Operatien tweede deel, cap. 1. p. 118.

^s Cours d'Operations de Chirurgie, demonstrat. 5. pag. 296.

^t De Morbis, Lib. III. cap. penult. Charter. Tom. VII. pag. 593.

next to be made with a knife, or some cutting instrument, not with a pointed one, as in the paracentesis of the abdomen, which is made by a steel bodkin, included in a silver canula; because there would be great danger of wounding the lungs by puncturing in that manner. But in order for a cutting instrument to penetrate into the cavity of the thorax, the skin, panniculus adiposus, *latissimus dorsi*, and intercostal muscles, with the pleura must be divided; to perform which with safety, the patient should incline his body a little backward to relax the skin, that the surgeon may elevate all the common integuments together, with the *latissimus dorsi*, if possible; and that being thus elevated, he may divide them at one and the same time, with a wound sufficiently large, and of the length of three or four fingers breadth. This done, the patient should incline his body a little backwards, and towards the opposite side, that the ribs may recede more from each other, and the intercostal muscles be extended; then may the surgeon cut through the tense intercostal muscles and pleura, with a scalpel a little crooked, along whose whole back the fore finger is to be applied, and at the same time the point of the knife is to be covered with the end of the finger, penetrating carefully into the cavity of the thorax by a small wound, to avoid injuring the lungs: as soon as the pleura is divided, the lungs immediately collapse and recede from the ribs; so that then the wound may be safely enlarged. But the incision is to be made parallel to the ribs, and in the middle space betwixt them, directing the edge of the knife downwards to avoid the intercostal vessels which lie hard by in a hollow fulcus or groove in the lower margin of the upper rib.

With these precautions, this operation may be very safely performed; though there are still a few more admonitions which occur in authors regarding the same, but which seem to be of less moment.

Thus

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Thus *Fabricius ab Aquapendente*^u will have it, that the patient ought to breathe out the air at the instant of making the perforation through the pleura, that by the recession of the lungs from the pleura at that instant, they may not be injured by the knife. But at this time of day we know from physiology, that the lungs are always contiguous to the pleura, both in expiration and inspiration, and that they follow the dilatation of the thorax. Hippocrates^w takes notice, that if the matter or water be all of a sudden discharged either by incision or caustic, from a patient who has an empyema or dropsy of the thorax, it kills him; and therefore some would not have all the extravasated blood extracted at once, but at several times. Now in an empyema, or in a dropsy of the thorax, the lungs have lain a long time macerating in the matter, or in the extravasated serum flowing all around, so that upon discharging the whole mass at one and the same time, the lungs might have their weakened vessels burst by the sudden dilatation of them with blood, whence sudden death. But when this operation is made in wounds of the thorax, it is very rarely that the case has been so long delayed, as to endanger any thing of this nature; and it appears from many chirurgical observations, that all the extravasated blood has been thus extracted suddenly or at once with safety. What renders this operation the more easily practicable, is the compressure of the lungs by the extravasated humours, and the depressure of the diaphragm by their weight, by which means those two organs are not easily injured upon perforating the pleura.

It was observed in § 297. that the lungs sometimes adhere to the pleura: now if this should unluckily happen in the place where the paracentesis is made, I say, if the lungs should there adhere to the pleura, it is evident that this will occasion no small difficulty. Most

^u Operat. Chirurg. cap. 45. pag. 490, 491.

^w Aphor. 27. Sect. 6. Charter. Tom. IX. p. 263.

of the writers in surgery, who have treated on this operation, testify, that they have met with this accident; and they then direct the surgeon to prudently separate the lungs from their adhesions to the pleura with his finger. At least, nothing more can be done than to make trial of this, though it may seem cruel thus to lacerate the adhering parts in a living man; but unless this be done, the paracentesis is made to no purpose. There is an extraordinary place in Hippocrates^x, which seems to point at this. For he there describes the symptoms which follow, when (ὁ πνεύμων προσπεσὼν ἐς τὸ πλευρὸν) *the lungs settle to the ribs or side*, and which agrees much with the appearances which are observed when the lungs adhere to the pleura, after acute or inflammatory diseases of the thorax; and to this also the cure which he proposes for the disorder, very well agrees. But he afterwards adds: *Si vero ex vulnere illud fiat, aut empyico seto (fit enim) huic vesicam fistulæ alligans, flatu implere, & intus immittere, & penicillum stanneum solidum imponere, & ulterius repellere (oportet):* “ But if this happens in a
 “ wound, or in the paracentesis for an empyema,
 “ you are to introduce a bladder fastened to a pipe,
 “ and fill it with wind; and you are afterwards to
 “ make a farther separation by a solid probe of tin.”
 From which passage we may conclude, that in order to separate the lungs from the pleura, Hippocrates introduced a complicated bladder through the wound, which he then inflated, and by the distention of the flatus within the cavity of the thorax, forced the lungs from the pleura, to which it adhered. At least, it seems to follow, that this separation of the lungs adhering to the membrane of the pleura, was attempted thus early. For fear of this adhesion, some advise to make a careful incision through the intercostal muscles without wounding the pleura, which is then to be diligently examined, to see whether any unusual thickness or callosity of it gives any room to suspect

^x De Morbis, Lib. II. cap. 23. Charter. Tom. VII. pag. 575.
 such

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such an adhesion of the lungs to that part; and if so, it will be adviseable to continue the incision a little longer, till you come to a part free from this cohesion. But this method of operating is more easily shewn in a dead body, than it is practicable in a living subject, where it seems very cruel to make such a slow and gradual incision. And there are also such ample adhesions of the lungs to the pleura sometimes observed, as may even render this method of operating quite fruitless. Thus I observed in the body of a young nobleman, who died suddenly of an apoplexy following an hemopthoë, such an adhesion of the middle lobe of the right side of the lungs every way to the pleura, as seemed to partition the right cavity of the thorax into two very distinct cells. If now in such a condition of the patient a wound was inflicted in the upper part of the right side of the thorax, it is then easily apparent that the paracentesis, made in its usual place, would be of no manner of service. But this is rarely the case; and a difficulty hence arising ought not to be ascribed to any default of the artist, but to the art, since there are no signs by which such an adhesion can be previously known.

The thorax being thus perforated, all the methods prescribed in the preceding paragraphs may be then put in practice, to discharge the extravasated blood. But if liquors are to be injected for dissolving the concremented blood, it will be most convenient to convey them in first by the inflicted wound, because of its situation in a higher part of the thorax, and then they may be easily discharged together by the new opening, when made.

S E C T. CCCIV.

IF these wounds are not distended with any tents, are seldom opened, and secured from the air; that air which was admitted may be expelled

pelled by an artificial sucking, and by proper efforts in respiration ; and if the cold be also carefully avoided, the cure may be then completed, when practicable, with ease and in a short time.

We before proposed (in § 299.) the reasons for which the use of tents ought to be rejected in wounds not penetrating the thorax ; nor do they seem to be less pernicious in such wounds as penetrate into the cavity of the thorax. But if they are at any time to be used, it is when the juices confined in the cavity of the thorax are not to be all discharged at once but at different times, which though sometimes necessary in an empyema or in a dropsy of the thorax, according to the admonition of Hippocrates, is very rarely required in wounds of the thorax ; but in the former cases they are inserted into the wound to admit of a discharge of the juices stagnating in the cavity of the thorax when it shall be thought proper. Even Belloste^a, who in other cases almost universally condemns the use of tents as pernicious, does yet allow, that they ought to be used for the first days after performing the paracentesis of the thorax to prevent a concretion of the pleura divided in the recent wound. But afterwards they seem to be always pernicious, since they swell or dilate by absorbing the juices, and rubbing against the sides of the wound by the motion of the thorax, render them callous and more difficult to heal. Some think by the use of them to prevent the ingress of the air into the cavity of the thorax ; but upon the removing the tent at each dressing, the air will have a very free ingress by the patent orifice, and its discharge will be afterwards prevented by the intrusion of a new tent ; so that, dilating by the warmth of the parts, it often makes itself surprising passages, and may produce the most malignant emphysemata. It is therefore better to cover the mouth

^a Chirurgien d'Hôpital, Part. III. Chapit. 6. pag. 228.

of the wound only with a flat pledgit, and leave a free passage for the humours to escape by the opening or wound, which being large, you ought then to be very careful that the pledgit does not slip into the thorax, which authors acknowledge has sometimes happened to the introduced tents. A Danish nobleman being wounded, and negligently treated by the surgeon, the tent slipped into the cavity of the thorax, and was six months afterwards discharged by the mouth; and yet the patient enjoyed a state of health after this ^b. A man was wounded with a sword into the right cavity of the thorax near the axilla betwixt the second and third of the true ribs; from which wound blood was discharged for the space of fifteen days, and some blood was also spit up by coughing. After many and very troublesome symptoms the wound at length was cicatrised; but a difficulty in breathing still continued with an incessant cough, and a spitting of a foetid and greenish matter. Three months being elapsed from the cure of the wound, the patient brought up a couple of tents, with a good deal of matter, which had slipped into the thorax from under the emplaster at different times during the cure of the wound ^c.

Another thing required here is to exclude the air from entering through the wound into the cavity of the thorax; or if it has once entered, to discharge it from thence. But it is impossible to exclude the air so long as the extravasated humours remain there, since they require a free passage; but when nothing more is discharged from the wound, when the air lodged in the cavity of the thorax, betwixt the lungs and the pleura ought to be extracted, and all possible care taken to prevent it from entering again. For it appears from physiology, that it is necessary there should be no air in the cavity of the thorax, in order for the free expansion of the lungs by inspiration.

^b Tulp. Observ. Medic. Lib. II. cap. 15. pag. 123, 124.

^c Hildan. Observ. Chirurg. Cent. 1. Observ. 46. pag. 41.

Now this discharge of the air may be procured either by sucking, or by the method following, which is the best of any. Let the lips of the naked wound be pressed together by the fingers in such a manner, that no air can enter, and then let the patient draw in a large quantity of air into his lungs by a deep and long inspiration, and let him retain this air as long as he well can: now the air thus retained being rarefied by the heat of the parts, will expand the lungs and compress the air lodged betwixt the lungs and the pleura. If then the lips of the wound are opened or drawn asunder, a great part of the air confined in the thorax will be expelled; after this the lips of the wound are to be immediately closed again, before which the patient must not expire. By repeating this method several times the whole quantity of air may be entirely expelled from the cavity of the thorax, and the patient will directly perceive, that he can breathe much more commodiously. All the air being thus expelled, let a sticking plaister be immediately applied at the instant when the patient retains the inspired air in his lungs; at which time the lungs, being distended and contiguous to the pleura, will obstruct the passage of the air about to enter through the wound. This emplaster is to be continued upon the parts for a very considerable time; and when it is necessary to renew the dressings, another sticking plaister of the like kind is to be applied with the same precautions; and if the seldom dressing of a wound is ever useful, it must certainly be so in these wounds of the thorax. The usefulness of this method is proved by the experiments made on living animals, as described under § 170. numb. 4. For when each side of the thorax was perforated with a large wound, the respiration wholly ceased, and the animal seemed dead; but the intruded air being by this artifice expelled from the cavity of the thorax, the animal revived, and immediately recovered its voice which it had lost.

But

But since all the parts contained in the thorax are near the fountain of heat, the heart, and are continually cherished with a gentle warmth, therefore the utmost caution is to be used to preserve them from the contact of the unusual cold; and therefore a warm air is always necessary here, when the dressings are to be renewed.

By this method wounds of the thorax have been sometimes cured, even though they have been very dangerous, and attended with the most severe symptoms; and that we ought not easily to despair in the worst of them, may appear from the extraordinary observations given us, and of which several such instances were related in § 170, from authors of the best repute. There is doubtless at all times reason to fear much danger in these wounds, since the vital viscera, namely, the heart and lungs, with the largest blood-vessels of the whole body, are here seated: but since even wounds of the heart itself are not always absolutely mortal, (of which viscus Pliny says^d, *quod solum hoc viscerum vitiis non maceratur, nec supplicia vitæ trahit, læsumque mortem illico affert*; “that this
“viscus only does not waste with diseases, nor does it
“receive life from any other part, and being wound-
“ed, produces instant death,”) it is evident, that even in the most dangerous wounds there is always some hopes of a recovery remaining; since men have sometimes recovered when they have been left for dead after wounds of the largest vessels, when no manner of care was taken of them, nor any cordials given to strengthen them. It is also not only evident, that the most dangerous wounds of this kind have been cured, but that even in a very short time likewise. A captain had the right side of his thorax perforated with a sword near the axilla, and in a very short time lost seven or eight pounds of blood; nor did the hæmorrhage cease, even though the wound was dressed up ~~with~~ with a suitable apparatus; and his

a C. Plinii Secundi Natur. Hist. Lib. XI. cap. 37.

48 Of Wounds in the THORAX. Sect. 304, 305.
 pulse weak and unequal, frequent fainting-fits, a fever, &c. afforded no good presage. The day after, the hæmorrhage not yet ceasing, the patient was obliged to change his place of residence, insomuch that every one believed he would expire in the journey: and yet the wound being only covered with a plaister, the patient was so much relieved by a copious discharge of urine, a spitting of blood, and a profuse sweat on the next night, that all the symptoms vanished, and the wound was in a short time cured barely with an incarnative emplaster, so that on the fifth day after the wound was received, he could ride a horse very well, nor did he from that time any longer keep his bed in the day^e. Many such instances are to be found in the same author, which teach us, that the most violent wounds of the thorax, attended with the worst symptoms, have been happily cured in a very short time without the use of tents, and with seldom renewing the dressing.

S E C T. CCCV.

AN D thus all those severe symptoms will be prevented, which we mentioned (301.)

The very worst symptoms which appear after wounds in the thorax, arise almost entirely from the air admitted into its cavity; or from the extravasated juices diminishing its cavity, or else corrupting and injuring the included viscera. When these wounds are not filled with tents, the extravasated blood has a free exit, and the seldom dressing, with the precautions before delivered, will prevent the air from entering, and that which has been already admitted may be expelled by the methods before described. By these means the cure always happily succeeds, unless some part be injured, without the integrity of which life cannot subsist: and it is also from hence appa-

^e Belloste Chirurgien d'Hôpital, Part. II. chap. 8. pag. 92.

rent, that the history and treatment of wounds in the thorax afford much light into several other disorders of the thorax and its contained viscera; as will afterwards appear, when we treat of the empyema and dropsy of the thorax.

Of Wounds in the ABDOMEN.

S E C T. CCCVI.

WOUNDS of the abdomen not penetrating into its cavity are discovered to be such; 1. by the probe, and by their course or situation; 2. by injection; and 3. from a knowledge of the nature of the wound, and of the wounding cause or instrument.

The trunk of the body is divided into two large cavities, of which the upper and lesser is called the thorax, and the lower and larger the abdomen. But the cavity of the abdomen is divided from that of the thorax by the diaphragm; and therefore all the parts of the trunk below the diaphragm appertain to the abdomen, whether they be parts containing or contained. The whole circumference of the thorax is encompassed by the ribs; but the greatest part of the abdomen is defended only with the soft integuments. For if we except the superior and lateral parts of the abdomen on each side, which are encompassed by the spurious ribs, behind which the large liver and spleen are safely placed, as being the most friable or tender of the abdominal viscera; to which if we add the column of vertebræ occupying part of the abdomen behind, and lastly the inferior and lateral parts, which are defended by the ossa innominata on each side; excepting these, all the other parts of the abdomen are soft. As the cavity of the thorax is invested on

all sides with a membrane called the pleura, so the cavity of the abdomen is also every way lined with a similar membrane, named the peritonæum. And from hence it is, that wounds of the abdomen are in general distinguishable like those of the thorax: for all wounds injuring the containing parts of the abdomen without dividing the peritonæum, are called not penetrating; as those which perforate the peritonæum are said to penetrate into the cavity of the abdomen. But whether or no wounds thus penetrate, is discovered by the following signs.

1. Of this we treated in the commentaries on § 300. numb. 2. but in the abdomen the difficulty is still greater, especially in corpulent habits, where the abdomen is covered with a vast quantity of fat. From hence it is, that the most skillful surgeons have affirmed, that nothing certain can be discovered in these wounds by searching with the probe for a change in the situation of the parts, a tumour of the lips of the wound, grumes of congealed blood obstructing the wound, or the fat pressed into the wound, may hinder the passage of the probe when it has been introduced at the mouth of the wound. To these add, that the patient is often ignorant of the posture of body in which he was when the wound was inflicted.

2. As when warm water is injected by a syringe at the mouth of the wound: of which we treated in the commentaries on § 300. numb. 4.

3. For if from the figure of the wounding instrument, compared with the width of the wound, it shall appear to have penetrated deep and in a rectilinear position, we may then conclude the wound has passed into the cavity of the abdomen; and the reverse, if from the same signs the wound shall appear to have been inflicted superficially or obliquely. It is easily apparent, that a wounding instrument may penetrate to a considerable depth without perforating the peritonæum in those who have their belly prominent with fat to the thickness of half a foot.

S E C T. CCCVII.

IF these wounds penetrate almost as deep as the peritonæum, the integuments being there weakened, may give occasion for a hernia to be formed in a robust patient; than which nothing can be worse, if the fistulous wounds run obliquely betwixt the integuments of the abdomen.

To what a degree the peritonæum may be extended is sufficiently evident in women with child, and in those afflicted with dropsies; from whence wounds, not penetrating the abdomen, have a circumstance peculiar to themselves, which being neglected has often produced a train of the worst consequences. For the diaphragm being depressed at every inspiration, all the contents of the abdomen are thereby compressed, and again in expiration they are repressed by the abdominal muscles; whence it is evident, that the contents of the abdomen receive a continual pressure from the diaphragm and muscles of the abdomen. If therefore the equality of this pressure be removed in any part by a wound in the integuments extending almost to the peritonæum, that membrane being easily dilatable, will be extended by the force of respiration so as to form a sacculus, into which the intestines, omentum, &c. may enter, and form an hernia, which is no more than a dilatation of the peritonæum in some part, into which the contained viscera of the abdomen may prolapse or enter. For it is very rarely, if ever, that an hernia is formed by a rupture of the peritonæum, but almost constantly from an expansion of that membrane into a sacculus; notwithstanding Celsus^a seems to have been of another opinion: and we are taught by most certain observations, that ruptures may be formed in any part of the abdo-

^a Lib. VII. cap. 4. pag. 413. & ibid. cap. 17. pag. 454.

men where the equable pressure is removed from the peritonæum. In the dead body of a woman, an hernia was found on the left side of the linea alba, four fingers breadth above the navel, and which contained a portion of the omentum and intestinum colon. This rupture arose from a violent blow received on this part of the abdomen ^b. Sennertus ^c relates a wonderful case, which teaches us, that a weakness in any part of the abdomen may occasion very large hernial tumours. A cooper's wife, in helping her husband to bend one of the staves, was by the return of it struck on the left inguen. A small tumour arose soon after in the part, which in a little time increased greatly; it afterwards appeared, that the increasing uterus of this unhappy woman, big with child, had got into a large sack formed by a dilatation of the integuments of the abdomen; in which place the motion of the living foetus might be perceived both by the eye and touch: and as there seemed to be no other remedy left at the time of birth, the infant was delivered alive by the cutting open of the womb; at which time Sennertus being present saw, that the peritonæum was not ruptured but entire, only considerably dilated by the bulk of the womb. After the cure of a wound in the abdomen, a considerable hernia was formed in the part where the wound had been made, which neglected by the man, he six years afterwards died of a gangrene in that part ^d. Now the stronger the person thus wounded is, the more liable is he to a future rupture there, because the pressure acts so much the stronger on the rest of the abdomen, whereby the weaker place will be more easily and speedily dilated. To which add, that strong bodies are usually employed in violent exercises, whence the least resisting parts will be again more dilated by the greater efforts of respiration.

^b Acad. des Sciences, l'an 1714. Mem. pag. 259.

^c Lib. IV. part. 1. sect. 2. cap. 16. Tom. III. pag. 39.

^d Tulp. Observat. Medic. Lib. III. cap. 20. pag. 211.

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Than which nothing can be worse, &c.] It is well known that a large quantity of fat is always seated upon the abdomen, unless the person is very lean; and this fat is not only spread upon the muscles of the abdomen, but is also interposed every where betwixt them: if therefore a wound should run obliquely betwixt the integuments of the abdomen, the extravasated humours or matter there collected, and not meeting with a free discharge through the mouth of the wound from some impediment, often burrows or makes its way surprisngly through the substance of the panniculus adiposus, and forms deep sinuosities betwixt the interstices of the muscles, in which case the cure becomes extremely difficult; and frequently it is even wholly impracticable to cure these fistulous ulcers following from wounds of the abdomen, since it is there necessary either to compress the bottom of such a fistula by an artificial pressure, while its aperture continues open; or else to lay open all its mæanders by incision. But that both those methods are often impossible to be used in these cases will readily appear to any one who considers the great thickness of the adipose membrane there, and the interposition of it betwixt the interstices of the abdominal muscles. Celsus^e takes notice of these very bad fistulæ being formed here, when he says, *Ventri nullum os subest; sed ibi perniciosæ admodum fistulæ sunt: adeo, ut Sôstratus insanabiles esse crediderit. Id non ex toto iter se habere usus ostendit;* “ There is no bone placed
“ under the abdomen; yet there are very bad fistulæ
“ seated there, insomuch that Sôstratus believed them
“ incurable. But that they are not always incurable,
“ experience demonstrates.”

But Celsus chiefly believed fistulæ of the abdomen to be dangerous, because being laid open they occasion ruptures; and therefore he says^f, *Tutior fistula est contra jecur et lienem et ventriculum, quam contra intestina; non quo perniciosior ibi res sit, sed quo alteri*

^e Lib. VII. cap. 4. pag. 413.

^f Ibidem.

periculo locum faciat; “ A fistula seated opposite to the liver, spleen or stomach, is less dangerous than one opposite to the intestines; not that the effects are there worse in themselves, but because they there make way for another disorder.” Tulpus^g laments an incurable fistula in a girl, which arose by a long and winding course from one of the spurious ribs which was carious. Many more of these cases have been observed, of which we shall speak more largely when we come to treat on fistulæ; it will be sufficient at present to produce one or two instances. A captain received a wound at the distance of two fingers breadth from the navel by a sword, which penetrated upwards and backwards: as the wound did not penetrate the cavity of the abdomen, it was only covered with a single and flat pledgit and a plaister, so that on the next day it was closed. The abdomen was wonderfully painful and swelled for six days afterwards; but by the use of phlebotomy and the application of emollient fomentations to the abdomen, the pain was abated, and the next day a small prominent tumour appeared in the place of the wound, which being opened, discharged an incredible quantity of matter, and was perfectly cured in the space of eight days^h. In another wounded patient, the sword entered the epigastrium at the distance of two fingers breadth from the linea alba: and as the sword was flat and easily flexible without breaking, it went according to the course of the ribs quite to the vertebræ of the back, from whence a fistulous ulcer was formed, the bottom of which being opened, a happy cure followedⁱ.

^g Observ. Medic. Lib. III. cap. 28. pag. 230, 231.

^h Traité complet de Chirurgie, par Mr. de la Motte, Tom. III, pag. 97.

ⁱ Ibid. 108—113.

S E C T. CCCVIII.

T Herefore in these wounds recourse must be had to future and bandage: and then in other respects, the treatment usual in common wounds will suffice.

What has been said of the cure of wounds in general is applicable to these, and will be sufficient for the cure, if there is no danger of ruptures or fistulæ. Narrow and deep wounds of the integuments easily degenerate into fistulæ; and therefore care must be taken by an artificial pressure and a proper posture of the patient to prevent the confined humours from forming sinuses in the panniculus adiposus. But the broader sort of wounds in the integuments very much endanger ruptures, whence it will be proper to unite them by future, (see § 214.) and to secure the weakened part by an artificial application of compresses and bandages, that the contents of the abdomen being pressed there may not dilate the peritonæum. But since every strong effort in respiration is here very pernicious, therefore every thing which occasions the person to breathe stronger than usual ought to be studiously avoided: and more especially care must be taken not to retain inspired air by shutting the larynx, as is done for example in discharging the fœces of the intestines, especially when a strong effort is required to expel the indurated fœces. Therefore the bowels are to be cleansed with an emollient clyster, and then the diet ought to be of such food as affords the least quantity of gross fœces to be collected in the intestines; such, for example, is the broth of flesh, with which alone life may be supported, and yet the patient may without damage continue a month without going to stool, because there are scarce any fœces thence accumulated in the intestines. For the same

reason the urine ought also to be retained for a considerable time, that it may be discharged almost spontaneously and with little or no straining. If any cough should attend, that must be appeased with diacodiates: laughing, calling out aloud, sneezing, and the like, are to be avoided as much as possible: and for the same reason absolute rest ought to be ordered to the patient.

S E C T. CCCIX.

BUT that such a wound penetrates into the cavity of the abdomen will appear, 1. by the probe, and posture of the patient: 2. by injections: 3. by a knowledge of the wounding instrument and nature of the wound: 4. by the egress of the contained parts.

We have already treated of the signs comprised in the three former numbers of this aphorism, at § 306. and § 300. numb. 1, 2, 4.

4. If those parts which we know are contained in the cavity of the abdomen come out through the wound, no doubt can then remain, but the wound has certainly penetrated into the cavity of the abdomen. But more especially the omentum and intestines fall out, when the abdomen is perforated. It is easy to discover when the intestines are prolapsed, but in corpulent people, the fat being free from the pressure of the divided skin, often protuberates through the mouth of the wound, and resembles the fat of the omentum, which may occasion an error in the diagnosis of a wound. At the same time also a wound penetrating into the cavity of the abdomen may be so obstructed or closed by this protrusion of the fat, that neither the probe nor the injection of warm water can discover that it penetrates. If in such a wound there is a discharge of any of the humours belonging

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to the abdominal viscera, as blood, urine, bile, &c. of which we shall treat in § 312. this is an evident sign, that the wound not only penetrates the cavity of the abdomen, but has also injured some of the parts therein contained.

S E C T. CCCX.

BUT if all the symptoms are slight, without pain, fever, or inflammation, no blood comes from the wound when the patient lies upon it, and the injected liquor returns unaltered in its colour, we then know that the internal parts are not injured.

After the signs make it evident, that the wound has penetrated into the cavity of the abdomen, the next enquiry must be, whether or no any of the viscera or vessels contained in that cavity have received any injury. But since all the viscera conduce to health by their functions, it will immediately appear, that if no great disturbance of the functions can be observed depending on the continuity of those viscera, that no part of any moment is injured in the abdomen. And as the abdominal viscera are principally subservient to chylification, therefore if the retention and conversion of the aliments into chyle, the absorption of that, and the expulsion of the remaining fœces, are performed as they usually were in health, we may be certain that the wounding instrument has not injured any of the abdominal viscera, notwithstanding its having penetrated into the cavity of the abdomen. But as the organs, which serve for the separation and discharge of the urine and to generation, are (with some impropriety, because seated without side the peritonæum) said to be seated in the abdomen; therefore enquiry must be made, whether
I any

58 Of Wounds in the ABDOMEN. Sect. 310, 311.

any of the symptoms consequent on the wound demonstrate that these parts are injured.

Besides these injuries of the abdominal viscera, it sometimes happens, that barely a division of the nerves in the mesentery produces the most dangerous symptoms, and even death, as we observed from Ruysch in the comment on §. 170. numb. 3. but in that case the intense pain, fever, and inflammation, sufficiently declare the danger that is present. Therefore if these symptoms are absent, there is all the reason imaginable to expect a happy cure. But also the large vessels, which convey blood, chyle, and lymph, may be injured by wounds in the abdomen; and therefore if the patient lies upon the wound, sufficiently large or open, and no blood or other juice is discharged, we thence know that those vessels are not injured; but as extravasated blood may congeal, and remain in the cavity of the abdomen without running out through the wound, therefore the surgeon injects warm water with a syringe at the mouth of the wound, which returning unaltered, nothing of this nature can be feared. But it must be remarked, that in an healthy living person the cavity of the abdomen is always full of moist vapours, which appear very manifestly upon opening the belly of an animal just killed: and these being condensed by the cold of the air admitted, or by any other cause, may flow from the wound in form of a condensed and collected lymph, though none of the internal vessels are injured.

S E C T CCCXI.

THE air must be immediately excluded, and that which entered must be expelled by sucking and the effort of expiration; the integuments are then to be sewed together by the operation termed gastroraphia, laying aside the use of tents; and thus the cure of the wound will be completed

completed by dressing seldom and with vulnerary balsams, and by the patient's lying upon the wound, keeping to a spare, moist, and healing diet, with rest of body.

The air must be excluded, &c.] When it appears from the signs before described, that none of the contained parts in the abdomen are injured, such a wound then requires to be immediately healed up. But it is to be observed, that the air will sometimes enter through the wound, and being retained in the cavity of the abdomen, it may be there greatly rarified and expanded by the heat, so as to compress all the viscera, if it be hindered from escaping again through the wound. Now from this air insinuating itself into the panniculus adiposus may arise wonderful emphysemata, as we observed in wounds of the thorax at § 300. numb. 5. Therefore before the consolidation or closing of such a wound is attempted, one ought to be satisfied, that no air remains in the cavity of the abdomen; and if there is any there, it must be first discharged in the manner we directed in § 304. namely, by letting the patient retain the inspired air as long as he well can, and then to make a strong effort of expiration while the larynx is shut; for thus the contents of the abdomen will be strongly compressed by the descent of the diaphragm and contraction of the abdominal muscles during the nifus of expiration, and thus the confined air will be expelled through the mouth of the wound. But to prevent the omentum or intestines from being forced out at the same time, the wound may be covered with a piece of open linen, which will transmit the air and restrain the other parts from coming out.

The air being thus excluded, it is then required, by the general indications for the cure of all wounds (§ 185. numb. 3.) to unite again the parts which have been separated by the wounding instrument, and to
retain

retain them in that union; and this is performed in wounds penetrating the cavity of the abdomen by a particular method, namely,

By sewing together the integuments.] This operation has been long ago described by the antients, who seem to have attempted it different ways. Galen^a fearing lest the divided lips of the peritonæum should not conjoin with each other, because he judged a membrane to be nervous and bloodless, would therefore have this operation performed so, that the divided lips of the peritonæum might unite with the opposite sides of the wounded lips of the abdomen. For he orders the needle to be carried from without inwards through the skin without perforating the peritonæum, and then with the same needle he sews the peritonæum, with all its incumbent integuments, to the opposite side of the wound; which done, he afterwards passes the needle through the same side of the wound from without inwards, perforating the skin and muscles again without touching the peritonæum; and then again, on the opposite side he perforates the peritonæum, and sews it to all the incumbent integuments, by passing the needle from within outwards. By this method he endeavoured to cause the divided peritonæum to unite with the opposite side of the divided abdominal muscles. But there is still another method proposed by Galen in the same place for performing the gastroraphia, by which the parts are united and consolidated each with its fellow; viz. the peritonæum with the peritonæum, and the muscles with the muscles, &c. and which therefore seems to be the better method of the two. Celsus^b, in describing this operation, orders it to be performed, so as to make the suture first upon the most internal membrane; and that being done, to pass the same needle and thread through the skin, and to unite the lips of the wound by suture in the

^a Meth. Med. Lib. VI. cap 4. Charter. Tom. X. pag. 140, 141.

^b Lib. VII. cap. 16. pag. 453.

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same manner: for, says he, neither the future of the skin, nor of the peritonæum, will be sufficient alone, but both are necessary. He would also have the future performed with two threads, and thicker than are usual in other wounds; because they may be more easily broke by the motion of the abdomen, and because the parts here are not exposed to so great an inflammation. In making this future it is principally required to give the patient as little pain as possible, and to avoid injuring either the omentum or intestines; nor is there any danger of the future being torn open by the continual motion of the abdomen. But since the skin of the abdomen is very tough and difficult to perforate, as all those have experienced who have sewed up the abdomen after it has been opened in dead bodies; therefore it is required to have the needles very sharp pointed, and with cutting edges, extending to about a third part of the length of the needle, which is to be so far crooked, and the remainder strait. The thread must be strong, or else several times doubled, not twisted together, but disposed in the same plain, the extremities of which are to be passed through the eyes of two of the fore-mentioned needles; and then the point of one needle, being concealed by the flesh of the fore-finger, is to be cautiously conveyed under the peritonæum in the cavity of the abdomen to avoid injuring the omentum or intestines; then let the peritonæum and integuments be perforated, by passing the needle at about the distance of a finger's breadth from the edge of the wound. In the same manner let the opposite lip of the wound be perforated with the other needle, and the thread, being drawn through, is to be afterwards tied in a knot upon small compresses first placed underneath for that purpose. In this manner is the future to be repeated according as the length of the wound requires. What else is necessary to be observed in performing the operation of gastroraphia may

may be seen in Garengeot ^c and the other writers on operations; see also what has been said in the commentary on § 214.

The use of tents is to be laid aside.] For these are in this case pernicious, since the divided parts require to be united, which union will be always impeded by the interposition of any foreign body. But the pernicious consequence of using tents in wounds of the abdomen has been shewn both from reason and experience by Belloste ^d.

By the patient's lying upon the wound, and dressing it with balsam, &c.] since the union of the lips of the wound requires them to be brought together by suture, their consolidation may be procured barely by dressing with a small quantity of some vulnerary balsam, or the application of a small pledgit moistened with the like balsam, agreeable to what we observed under the cure of wounds in general § 204. But the posture of the patient is required to be such, that the matter and other extravasated juices may have a natural tendency to be discharged from the wound, which must therefore be laid upon. Absolute rest is here required, because motion of the body, coughing, laughing, sneezing, or difficult going to stool, augments the force of respiration, so as to endanger a laceration of the suture; or at least those violent motions of the abdomen would distract the threads and irritate the conjoined parts, whence inflammation, pain, and their bad consequences may follow. For those reasons also a moistening and mild diet is necessary to be taken in a small quantity at a time, to avoid a repletion and distention of the stomach and abdomen; flesh broths are principally recommended here as we observed in the commentary on § 308. If now neither pain, itching, nor inflammation, *etc.* follow, seldom dressing of the wound will hasten the

^c Traité des Opérations de Chirurgie, Tom. I. pag. 124, &c.

^d Chirurgien d'Hôpital, Part. II. chap. 15. pag. 114, &c.

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cure, as we said before in the cure of wounds in general.

S E C T. CCCXII.

BUT if the pain is acute, and there are signs of a fever or inflammation or if the wound discharges blood, ichor, food, drink, or chyle; or else if it discharges matter, bile, urine, or fœces, with a stench; in these cases, by considering the wounding instrument with the situation and nature of the wound, the paleness, inquietude, faintings, cold sweats, and deficient pulse in the patient; all these will indicate, that some, and which of the abdominal viscera are injured.

Hitherto we have considered wounds of the abdomen, which either injure the common integuments only, the peritonæum remaining entire, or which penetrate into the cavity of the abdomen, but without injuring any of the contained viscera or vessels. We come now to those signs, by which we know, that some of the contained parts of the abdomen are injured; and from which signs may be concluded what parts contained in the cavity of the abdomen have been wounded. But all these signs are either taken from, the matters discharged through the wound, or else from the injured functions.

Acute pain.] This is a symptom highly to be suspected in wounds of the abdomen, denoting, that some of the membranous or nervous parts are injured. But how dangerous injuries of these parts are, may appear from what has been said in § 170. numb. 3. where it is evident from the observations of Ruysch, that wounds inflicted on the mesentery, without injuring any other parts, have produced the most excruciating pains of the abdomen, and proved fatal within two or three days; it also appears very probable,

ble, that all these symptoms follow from the injured nerves in the mesentery. Celsus ^b enumerates among the signs of a wound in the liver, shooting pains extending to the throat, and very severe where the neck is joined to the scapula of the same side. In wounds of the kidneys he observes, that the pain descends to the groins and testicles: and the parts of generation in the female being wounded, he says excite a pain in the groins and hips.

Fever.] Which if it does not arise from a disturbance of the mind in the wounded patient, is always the consequence either of severe pain or inflammation, which must be always very dangerous in these nervous parts, as the mesentery, intestines, &c.

Inflammation.] The signs of which are, a shivering, and the feverish heat which follows, with thirst, anguish, difficult respiration, a hard pulse, dry tongue, &c. But how fatal an inflammation is in most of the abdominal viscera, we are taught by the iliac passion and hernia incarcerata, in which diseases even the most robust people perish in a few hours time.

Blood.] Which denotes that some of the larger blood vessels are injured, and that it is arterial, if it is discharged impetuously and of a very florid colour; but venal, if it appears of a darker colour.

Ichor.] Such a thin liquor may be discharged from various parts injured by the wound penetrating the abdomen. There are here a great many lymphatic vessels, which may discharge such a juice; or if the pancreatic duct, porus hepaticus, or pelves of the kidneys are wounded, they may discharge an incredible quantity of such an ichor into the cavity of the abdomen. Even the vapours, which replenish the cavity of the abdomen in an healthy animal, being discharged from the perspiring vessels, and condensed by the cold of the air admitted through the wound, without being absorbed again by the veins, will be here collected, and often discharged in a very confi-

^b Lib. V. cap. 26. pag. 286.

derable quantity from the mouth of the wound, when none of the internal parts are injured.

Food and drink.] These denote that the stomach is injured; wounds of which are always dangerous, but not absolutely mortal; as appears from what has been said in the commentary on § 170. numb. 5. to which we may add the instance related in the *miscellanea curiosa*^b, of a man, whose stomach being wounded, and the lips of the wound becoming callous, did not unite, but part of the food and drink were discharged through the opening of the wound during the space of eleven years.

Chyle.] If this is discharged through the wound, it denotes, that the small intestines are injured, or that the chyloferous ducts are wounded, in which latter case the colour of the chyle is much whiter, whereas the chyle of the small intestines always appears more of a grey or ash colour, and when the small intestines are wounded near the stomach, where the bile mixes itself, the chyle appears then of a yellowish colour.

Bile.] Which denotes an injury either of the common or cystic duct, or of the duodenum wounded in or near that part where it receives the common duct; but more especially a large quantity of bile is discharged from the cavity of the abdomen when the gall bladder itself is wounded. There is a very remarkable case of this nature related in the philosophical transactions^c, of an officer, who received a wound penetrating the cavity of the abdomen, and entering the bottom of the gall bladder, without offering any considerable injury to the other adjacent parts. The symptoms which followed this wound were surprizing enough, for the abdomen was immediately distended, as if the patient had been afflicted with an ascites or tympanites, nor did the swelling either increase or diminish till the patient's death, which happened a week after the infliction of the wound. There were

^b Decad. 2. Ann. 5. pag. 2.

^c N^o 414. pag. 341. Abridgm. Tom. VII. pag. 571, 572.

no belchings, flatus, or rumbling noise, and the bowels continued strictly constipated during the whole time, notwithstanding strong purges and clysters were used. The patient had scarce any sleep, even though opiates were given in a very considerable dose. The wound appeared externally pale, flaccid, and without matter. The pulse was strong, equal, and slow, but the day before death it was sometimes a little intermitting, and the patient's senses continued even till death; a slight hiccup and nausea attended the fifth day after the wound was inflicted. From this history it is evident, that a discharge of bile from a wound of the abdomen is a very bad sign.

Matter.] Which denotes a suppuration made in the internal parts from the inflicted wound, unless perhaps the patient should have had a purulent vomica before, which the wounding instrument has now opened.

Urine.] Which being discharged from the wound, signifies, that the pelvis, ureter, or bladder is injured, as any one may readily perceive.

Fœces or stench.] It appears from physiology, that the ingested aliments are by degrees so drained by the action of the stomach and small intestines, (the more fluid parts being absorbed by the bibulous mouths of the meseraic and lacteal vessels,) that towards the end of the intestinum ilium scarce any thing more than the insoluble fœces remain, which slip into the intestinum cæcum, from whence they are by degrees protruded through the whole length of the colon to the rectum, where they make their exit. Now it has been observed, that no stench (which is the sign of incipient putrefaction) is perceptible in those relicts of the chyle, unless in the cæcum, colon, and rectum; but never in the small intestines. For this reason *Helmont*^d says, *sedere stercoreum fermentum, corruptionis opus, non nutritionis*; “ that a stercoraceous ferment is seated in the intestinum cæcum, not for

^d *Ortus medicin. pag. 179. n^o 81. in fine capituli: Sextuplex digestio alimenti humani.*

“ the business of nutrition but putrefaction.” When therefore the fœces are discharged through the wound, or when their fœtid smell is expired through the wound, we may conclude that the large intestines are injured. Hence Celsus ^e, after saying that a wound in the stomach and small intestines have the same signs, he adds, *cætera intestina icta vel stercus, vel ejus odorem exhibeat*; “ that the other intestines being wounded, either discharge the fœces or their smell.

The wounding instrument, with the nature and seat of the wound.] If the instrument can be obtained with which the wound was inflicted, by comparing it with the width of the wound, it will often indicate how far the wound has penetrated: It is also evident, that the nature of the inflicted wound varies much according to the different direction in which the wounding instrument entered the cavity of the abdomen, either upward, downward, laterally, *etc.* also the situation of the abdomen and viscera may differ much according to the different posture of body which the patient was in at the time when he received the wound, and also according to other different circumstances. Thus the very accurate anatomist, Winslow, has observed ^f, that the liver in the human body is so firmly attached by its ligaments, that it cannot easily slip from one side to the other; yet that it is not absolutely suspended by them, but is in part sustained by the stomach and intestines, especially when they are full. Hence after long fasting, the liver descending by its own weight, pulls down the diaphragm, and occasions an uneasy sensation, which the same anatomist thinks is unjustly ascribed to the stomach. Therefore if a man be wounded when the stomach is empty and in an erect posture, at the distance of about two fingers breadth under the false ribs on the right side, in that case the liver may be injured, as it descends below the margin of the ribs; and of this na-

^e Lib. V. cap. 26. pag. 287.

^f Exposition Anatomique, &c.

Traité du bas ventre, n° 267, 268. pag. 350.

ture we have an instance related by Garengéot ^s of a man who died of such a wound, upon opening whose body an abscess appeared in the liver from this cause. The same is also true of the stomach, which when full frequently descends to a considerable degree.

Paleness, cold sweat, inquietude, fainting, and deficient pulse.] All these signs denote a deficiency in the vital powers, and generally follow a great loss of blood; therefore when these signs appear without any flux of blood externally from the wound, we ought then to think of an internal hæmorrhage, and conclude that the large blood-vessels are injured: for the blood being thus extravasated within the cavity of the abdomen returns only in a small quantity to the heart, whose force will be therefore diminished, whence the pulse begins to weaken, intermit, and at length wholly ceases in a perfect syncope. Hence paleness from a collapse of the empty blood-vessels, and a cold sweat, which are certain marks of weakness in the vital powers. Then begins that struggle of life with death which is commonly called an agony, namely, extreme anguish and inquietude, so that they are continually changing the posture of their body so long as their strength will permit, and at length a deliquium or death itself follows. Consult what has been said in the commentary on § 302. numb. 7.

Sometimes perhaps these symptoms may arise from an injury of the nerves, which are dispersed through the viscera of the abdomen. For that these nerves have a very great influence upon the vital functions, we are taught by sudden deaths which follow from the inversion of an intestine, or incarcerated rupture, *etc.* even in the most healthy and robust people; in which disorders all these symptoms appear, and are often followed with death in a few hours. Hence Celsus ^h, enumerating the signs of a wound in the

^s *Traité des Operations de Chirurgie*, Tom. I. pag. 84.

^h *Lib. V. cap. 26. pag. 287.*

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stomach, says, *Venarum motus elanguescunt, sudores tenues oriuntur, per quos extremæ partes frigescent*; “ That the pulse languishes, and thin sweats arise, in which the extremities grow cold.” And immediately afterwards he adds, that the signs of a wound in the stomach and intestines are the same.

From all these signs we know, that the parts contained in the cavity of the abdomen are injured, and frequently it is sufficiently evident from the same signs, which of the contained parts are affected; so that from hence we have a diagnosis of these wounds, and in the following aphorism we are taught their prognosis.

S E C T. CCCXIII.

THEN follow an infinite number of disorders, partly 1. from the nature of the viscera, which are not muscular, but composed of thin vessels, in which the circulation is difficultly performed, and not unless the abdomen be entire; 2. from an injury of the function of the viscus; 3. from the quantity and putrefaction of the extravasated blood; 4. from the pressure, rarefaction, and injury received from the air, which has entered through the wound.

1. It appears from physiology, that all the abdominal viscera, which are subservient to chylication, transmit all their venal blood to the sinus of the vena portæ, which immediately after divides and distributes all the received blood throughout the whole mass of the liver in such a manner, that the blood no longer flows from small to larger branches, but from a broad basis to a narrower, as in the arteries. Hence it is evident that the circulation of the juices must be here very difficult, since the venal blood having lost the greatest part of its motion, which it received

ceived from the heart and arteries, is here again obliged to pass through the narrow and converging vessels of the liver. But then this circulation of the juices is promoted by the action of the diaphragm and abdominal muscles, which press alternately upon all the abdominal viscera: for at the time of inspiration the diaphragm descends downward, and diminishes the cavity of the abdomen compressing all the contained parts, but at the time of expiration the muscles of the abdomen contract and re-act in the same manner upon the viscera. Hence the circulation of the blood is promoted through the abdominal viscera every moment of life by these alternate pressures, and from hence so frequently arise obstinate obstructions about the liver, spleen, and other viscera of the abdomen, in such people as, leading a sedentary and unactive life, neglect the healthy exercises of body, and from whence follow many of the most obstinate chronic disorders. When therefore this action of the diaphragm and abdominal muscles is disturbed or removed by a wound, it is evident, that this pressure will be wanting, which is required to promote the circulation of the juices through the abdominal viscera. This appears evidently in the dissection of living animals; for when the abdominal muscles are divided by transverse incision, all the veins of the abdominal viscera will in a few minutes time appear very much distended, because the venal blood cannot obtain a free course through the small vessels of the liver for want of this action of the abdominal muscles. In the mean time it is very evident, that this bad consequence is not to be expected from all wounds of the abdomen, but only from those which considerably injure the action of the diaphragm or abdominal muscles. Add to this, that the air rushing in through large wounds, may by the coldness of it, to which the abdominal viscera are unaccustomed, very much injure them, and from these two causes may be deduced

duced the reason why the omentum or intestines so easily mortify when they prolapse through a wound.

2. Each of these viscera have their particular uses subservient to the business of chylication, and therefore an injury offered to one or more of them will disturb the formation of the chyle. Thus for example, if one of the small intestines be divided near the pylorus, all the chyle will escape into the cavity of the abdomen, or be discharged through the wound, the body will be defrauded of its nourishment, and the patient will perish by a true marasmus. A wound of the gall bladder will extravasate that important juice into the cavity of the abdomen, as in the case we related under the preceding aphorism, whence the bowels will remain obstinately bound up, without being relieved by any medicines, accompanied with a sudden and lasting inflation of the abdomen, which are consequences that one would not easily foresee to happen from such a wound. Hence it is also evident, how necessary the action of the bile is towards that of most of the abdominal viscera. But the bile is formed from the venal blood coming from all the chylicative viscera, and perhaps of a different nature in each, being also wonderfully changed by the structure of the liver itself; whence an injury of the abdominal viscera frequently destroys something necessary to the secretion of good bile; and the bile therefore degenerating from its healthy or natural state, the formation of the chyle may be wonderfully disturbed. Thus the liver and spleen appear like a sponge full of blood, and therefore a quantity of blood being extravasated from a wound in either of these may produce inflammation, suppuration, or a conversion of those viscera into corrupt matter, *etc.* as one may reasonably expect.

3. A division of the blood-vessels, which are distributed in such numerous and large branches through the viscera of the abdomen, may evidently extravasate a large quantity of blood into the cavity of the

abdomen, where it may be injurious by its weight compressing the viscera, and also by its putrefaction, especially if the air is also freely admitted at the same time. But a small quantity of extravasated blood, without any considerable injury of the important viscera, is not judged very dangerous by Ruyfch^a, who made experiments of this kind on living animals, especially if the free access of the air is prevented; for that anatomist having first tied the splenic vessels in a dog of a moderate size, he afterwards cut out the spleen, but neglected to tie up the small epiploic artery, which discharged so large a quantity of blood, that the dog seemed as if he would shortly expire. He nevertheless protruded the artery without ligature into the abdomen, where it doubtless continued to bleed; he then united the wound of the abdomen by suture, and the dog afterwards did well, the wound healing in six or seven days time. From this experiment he concludes, that blood extravasated into the cavity of the abdomen, may be again absorbed, without any bad consequence following, provided the air is excluded.

4. If air enters through the wound into the cavity of the abdomen, and the orifice of the wound is in the mean time obstructed by the fat or any other cause, so as to prevent the air from escaping again, it may be rarified by the heat of the body, and distend the abdomen to an immense bulk: but at the same time it will compress all the viscera contained in the abdomen, more especially the stomach and intestines, which it may press quite flat; whence may follow miserable consequences, which can only be remedied by discharging the rarified air.

^a Observat. Anatom. Chirurg. 66.

S E C T. CCCXIV.

FROM hence these wounds are often mortal. But large wounds of the intestines which are accessible to the hand, must be conjoined by suture; or if the intestines are injured with small wounds, they may be left to themselves, and the remainder of the treatment performed as we directed at (311.)

From all that has been said it is evident, what a great diversity there is in wounds penetrating the cavity of the abdomen, and injuring the contained viscera or vessels. If now we consider what has been already said concerning the mortality of wounds in general, § 170. numb. 3, and 5, together with the wonderful disorders which have been observed to follow an injury of the diaphragm, of which we treated in the same section at numb. 4, it will easily appear that inevitable death must be frequently the consequence of wounds in the abdomen.

We come now to consider what ought to be done in the cure of wounds in the abdomen, when the intestines are injured, and are accessible to the hand. Hippocrates^a has pronounced wounds of the small intestines to be mortal; but Galen, in his commentaries, will not have every kind of wound in the small intestines mortal, but only such as penetrate into their cavity; and these, he says, are very rarely cured. In another aphorism Hippocrates^b says, that one of the small intestines being divided, it will not unite. Celsus likewise affirms, ^c *Si tenuius intestinum perforatum est, nihil profici posse. Latius intestinum sui potest: non quod circa fiducia sit, sed quod dubia spes certa despera-*

^a Aphor. 18. Sect. VI. Charter. Tom. IX. pag. 257.

^b Ibid. 24. Sect. VI. pag. 261.

^c Lib. VII. cap. 16.

tione fit potior: interdum enim glutinatur: “ If one of
 “ the smaller intestines is perforated, no good can be
 “ done. But one of the larger intestines may be con-
 “ joined by future: not that the cure will certainly
 “ follow by that means, but because a doubtful reme-
 “ dy is better in a desperate case than none at all; for
 “ sometimes it is healed.”

But it appears at present from a great many faithful observations, that the small intestines have been entirely divided, and yet the wounded patient has afterwards recovered. If therefore the intestines are injured with a small wound, not sufficient to let the contents into the cavity of the abdomen, they may be left to themselves, for in that case the cure easily succeeds spontaneously. For so soon as the intestines have prolapsed through the wound, they are usually greatly distended with flatus, if they are entire; and they then appear very thin and membranous: but if we consider them in their natural state, they appear sufficiently thick and compact, so that a small wound cannot much injure them. It is evident from the instance of the madman, which we mentioned in § 170. numb. 5. who inflicted eighteen wounds in his own belly; it is thence evident, that such wounds of the small intestines may heal spontaneously, as we are taught by the cicatrices of the healed wounds, which appeared in the body after death. When the small intestines of a dog are cut open longitudinally, as we mentioned in the same place, upon returning them into the abdomen without any future, the animal afterwards recovered. And observations teach us, that even pretty large wounds of the intestines have been cured spontaneously, though they were sufficient to let out the contents. A man was wounded with a large bullet, which perforated the cavity of the abdomen, and entered the intestinum colon, with considerable injury, insomuch, that for the space of two months time, the fœces were discharged through the wound; but at length the wound healed without any assistance
 from

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from art, and the man perfectly recovered. ^d An eminent cook was wounded in the abdomen with a knife, so that the edge penetrated the larger intestine or colon, on the right side; and though it hung out of the body for above the space of thirty hours, and was very much injured by the cold, yet it was returned again into its place without any bad consequence. The intestinal fœces were discharged daily through the mouth of the wound, and though the abandoned glutton observed no regimen of diet, yet the wound of the intestine was happily consolidated, as appeared in the dead body, six years after the wound was inflicted ^e.

But when wounds inflicted on the intestines are so large, that there is reason to fear their contents will escape into the cavity of the abdomen, where, being accumulated and putrefied, they may corrupt all the adjacent parts; in this case, if the wound of the intestine is accessible to the hand, it will be proper to make the future. In these cases surgeons generally use what they call the glover's future, because the skins of animals being lacerated, are usually mended by the dresser with this kind of future. This future is performed upon the intestine by perforating both the divided lips at the same time, with a needle armed with a flat silken thread; then the second stitch is made as before, at about the distance of two lines from the first, always beginning at one and the same side of the intestine, and repeating it till the lips of the wound are contiguous; thus will the divided lips of the intestine be retained in contact, by a spiral circumvolution of the thread, a pretty long piece of which is to be left pendulous out of the wound, that the conjoined intestine may be afterwards easily extracted. On this account the stitches are to be made at larger distances, and the ends of the thread are not to be continuous with the spiral circumvolutions,

^d Belloste Chirurgien d'Hôpital, pag. 266. part. 3. chapit. 15.

^e Tulpii Observat. Medicar. Lib. III. cap. 20. part 212.

which

which retain the lips of the intestine, as many authors direct; for then the threads cannot be drawn out of the wound without wrinkling the future of the intestine, which will produce acute pain, inflammation, gangrene, *etc.* Upon this future consult Garengeot ^f, who has given the best description of the method of performing it.

It is very apparent, that this future ought not to be performed but in case of urgent necessity, since it requires the intestine to be drawn out of the abdomen, and to be roughly handled for a considerable time, in the cold air; from whence fatal consequences have been observed to follow by several authors. But the instances which we alledged in the commentary on § 170. numb. 5, where the stomach itself, divided by a wound, was conjoined by future; and the instances which we shall hereafter produce in the commentary on § 317; sufficiently prove that this operation ought not to be condemned as useless or pernicious.

S E C T. CCCXV.

IF the intestine comes out uninjured through a large wound of the abdomen, let it be fomented by the application of live animals slit open, or with a proper fomentation, until it is replaced, and let the rest of the treatment be performed as in (311.)

So long as the intestines remain in the abdomen, they are on all sides moistened with warm vapours, and lubricated with a subtile oil, as we may be convinced barely from touching them in the dissection of living animals. Therefore when the intestines prolapse through a wound of the abdomen, being deprived of their moist and warm vapours, they soon

^f *Traité des Operations de Chirurgie, Tom. I. pag. 105, &c.*

become

become cold, dry, and often speedily tend to mortification; which we know chiefly by their change of colour. Celsus^a has beautifully expressed himself upon this subject, when he says, *Protinus considerandum est, an integra ea sint; deinde, an his color suus maneat, etc. Tum, si utrumlibet intestinum (crassum nempe et tenue) lividum, aut pallidum, aut nigrum est; quibus illud quoque necessario accedit, ut sensu careat, medicina omnis inanis est. Si vero ea adhuc sui coloris sunt, cum magna festinatione succurrendum est: momento enim alienantur, externo et insueto spiritu circumdata:* “It must
 “ be directly considered whether the intestines are
 “ sound, or whether they retain their colour, etc.
 “ Then if either of the intestines, whether large, or
 “ small, appears livid, pale or black, and without
 “ sense, which is a necessary attendant of these
 “ changes in colour, all remedies are then ineffectual.
 “ But if the intestines as yet retain their colour, as-
 “ sistance must be very speedily given; for they are
 “ soon changed by the unusual contact of the ambi-
 “ ent air.” And that Celsus well understood that the intestines are naturally moistened, not only with a thin lymph, but also with a fat oil, is very apparent; because he soon after adds, *b Ac, si jam sicciora sunt intestina, perluenda aqua sunt, cui paululum admodum olei sit adjectum:* “But if the intestines appear drier
 “ than they ought to be, they are to be fomented
 “ with water, to which a little oil is to be added.” When therefore the gyri of the intestines prolapse through a large wound, they are to be immediately replaced, if they are not yet become cold or dry. The retaining of the intestines will be much facilitated, if the patient is placed in such a posture, that the contents of the abdomen cannot press upon the part wounded by their own weight; and therefore Celsus^c would have the patient laid upon his back, with his hips raised. For in that posture the viscera,

^a A. Corn. Celsi Medicin. Lib. VII. cap. 26. pag. 452.

^b Ibidem.

^c Ibidem.

contained in the cavity of the abdomen, prefs the diaphragm into the cavity of the thorax; by which means the capacity of the abdomen is increased, so that the prolapsed intestines may be more easily replaced. In this reduction of the intestines, ^d Celsus again very well advises, *Quod Medicus priora semper intestina, quæ posteriora prolapsa sunt, condere debet sic, ut orbium singulorum locum servet. Repositis omnibus leniter homo concutiendus est, quo fit, ut per se singula intestina in suas sedes reducantur, et in his consistant*: “ That the surgeon should always operate so as to re-
 “ turn those intestines first which prolapsed last, that
 “ each of their gyri may keep its place. After they
 “ are all replaced, the person is to be gently shook,
 “ that each of the intestines may reduce itself to its
 “ proper place, and there remain.” For unless this be observed, violent gripes and many other bad consequences may follow.

Another admonition, of no small importance, is given us by ^e Garengéot; namely, that if the wound is in the middle of the abdomen, under the navel, penetrating through the rectus muscle, on either side, then the prolapsed part of the intestine or omentum is frequently liable to be returned under that muscle, betwixt its body and the tendinous capsule, which very loosely encompasses this muscle below the navel; since it might be thus falsely imagined, that the intestine is returned into the abdomen. It is sufficiently evident, that the very worst consequences must follow from such an error; namely, inflammation, pain, *etc.* in the intestine, thus violently compressed by the incumbent muscle.

But when the prolapsed intestines are already cold, or dried by the air, it will then be best to foment and moisten them before their reduction; for which purpose nothing better can be contrived, than the application of the intestines of a healthy living animal,

^d Ibidem, pag. 453.

^e Traité des Operations de Chirurgie, Tom. I. pag. 102.

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immediately after opening its belly; for then they are warmed and moistened in a manner with their natural foment. Hence this method is often the only relief that can be had in the iliac passion, and in the reduction of incarcerated ruptures. If living animals are not at hand for this use, warm milk and water, with a little oil, or fat mutton broth, boiled with emollient herbs, may be used for the same purpose, if they are always applied of a due warmth. It is indeed true, that upon returning the prolapsed and cold intestines into the cavity of the abdomen, they will be there warmed and moistened; but we ought first to be certain, that life still remains in the cold and senseless parts, before they are replaced, or else we may expect an absolute mortification, if they are already begun to be gangrenous; and though a separation of the corrupted parts should succeed there, the contents of the intestines would nevertheless escape into the cavity of the abdomen, whence the death of the patient would follow, after suffering the most miserable disorders.

S E C T. CCCXVI.

IF the intestine, coming through a small wound of the abdomen, cannot be reduced, either from its inflammation, distention with wind or fœces; let it be returned by the use of fomentations, by puncturing, or by dilating the wound.

When the abdomen is perforated with a large wound, the intestines easily prolapse; but then there is also no great difficulty in replacing them: but when part of an intestine has been forced through a narrow wound, the disorder is much more dangerous. For the prolapsed intestine being compressed by the margin of the wound, will soon be distended with
flatus

flatus, or the ingested aliments, drove thither by the peristaltic motion; whence the intestine will be inflamed, tumified, and incapable of being returned through the stricture of the wound; whence a stoppage of the circulation and a gangrene soon follow, as hath frequently been observed in incarcerated ruptures. It is very evident, that in this case the intestine cannot be reduced, unless the distention of it be first diminished, or the wound dilated; the former of which ought always to be first attempted, since the dilatation of the wound cannot be performed without pain and danger. Those fomentations may be therefore applied warm, which are directed under the preceding aphorism; and then it may be gently attempted by the hand, to propel the flatus or other contents through the wound, into the common tract of the intestine, by which means the tumor may subside, and the intestine may be reduced. But if it should continue distended with flatus, and fomentations have been used for some hours without effect, the distended part of the intestine may be then punctured with a needle in several places, to discharge the flatus. Nor is there any danger to be feared from these small wounds; for the flatus being discharged, the intestine will contract, and the small openings made by puncture will disappear; nor will they permit any of the intestinal contents to escape. ^a Parey tells us, that he has successfully used this puncturation of the intestine. But to prevent the ignorant from blaming or reflecting upon this method of perforating the intestine, it is best to perform it privately, as it may be done without difficulty. For the fatal event of such a wound might be sometimes ascribed to the surgeon, though he does no more in the case than what art evidently requires.

But if neither this method succeeds, a dilatation of the wound then only remains; which Celsus ^b has also

^a Livre X. Chapitre 36. pag. 256.

^b A. Corn. Cels. Medic. Lib. VII. cap. 16.

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recommended in this case, when he says, *Si angustius vulnus est, quam ut intestina commode refundantur, incidendum est, donec satis pateat*: “ If the wound is narrower than will conveniently permit for returning the intestines, it must be sufficiently enlarged by incision.” But great caution is here evidently required, because the prolapsed intestine, being very strictly compressed by the wounded lips of the peritonæum and integuments, may therefore be easily injured. To avoid this, the surgeon introduces a grooved probe or director into the cavity of the abdomen, drawing the intestine a little back at the same time, when that is found necessary; and then, that he may be certain the intestine is not intercepted, betwixt the director and the margin of the wound, he draws the intestine a little more out; he then introduces his incision knife into the groove of the director, and carefully divides the peritonæum: this done, he then elevates the director and incision knife lodged in its sulcus, and divides the integuments of the abdomen, till the wound appears sufficiently large, for the commodious returning the intestine into the cavity of the abdomen. But if the stricture upon the prolapsed intestine is so great, that it is impossible to introduce the director, then the intestine is to be pressed with the fleshy part of the fore-finger, that it may recede a little from the margin of the wound; and then let the integuments and peritonæum be divided a little, upon the nail of the same finger, to make way for the introduction of the grooved probe or director.

To perform this operation with the greatest safety, several useful instruments have been contrived by celebrated surgeons. Thus we are furnished with a director, which conceals an incision knife in its groove, that can be raised at the pleasure of the surgeon, by pressing upon a spring; the figure of which instrument may be seen in Heister’s surgery^c. Petit used

^c Institut. Chirurg. part. II. cap. 114. tab. 24. pag. 797.

§ 2 Of Wounds in the ABDOMEN. Sect. 316, 317.

only a straight incision knife, furnished with an obtuse point, and with a very dull edge: this knife he introduced perpendicularly into the abdomen, without danger of injuring the viscera; because it had a globular point, and would not easily cut; yet the edge of the knife was sharp enough to divide the very tense integuments of the abdomen^d. The simplicity of this method has pleased many, but there are other surgeons who prefer the former instrument.

The wound being thus dilated, and the prolapsed intestine returned, all the rest is to be conducted in the manner described at § 311.

S E C T. CCCXVII.

IF part of the intestinal tube is lost either by a wound, suppuration, or gangrene, and the upper part of the intestine offers itself, or can be carefully drawn out, it ought then to be sewed to the margin of the wound.

But if the intestine is entirely divided; or if prolapsing through a narrow wound, and not being returned in time, part of it should be destroyed by a suppuration or gangrene; in that case the continuity of the intestinal tube is removed; and if the divided ends are returned into the cavity of the abdomen, it is very evident that the chyle of the intestines, being discharged into that cavity, accumulated and there putrefied, must produce a train of miserable consequences, and inevitable death itself. The same is also true, if the intestine be returned entire, but invaded in some part with a gangrene; for the diseased part must then separate, whence all the same maladies will follow. All that art can then perform, is, to attach the end of the divided intestine to the ex-

^d Garengot *Traité des Operations de Chirurgie*, Tom. I. pag. 119.

ternal margin of the wound; and thus a filthy drain will be there fixt during life, which will supply the place of the anus. Physicians and surgeons formerly had no hopes of this concretion of the divided intestine; being opposed by the authority of Hippocrates^a, who says, *Si intestinum tenue dissectetur, non concrefcit*: “That if a small intestine be divided, it “does not heal or unite.” But we are taught by wonderful observations, that such a concretion is not always to be despaired of. A strong man had been afflicted with a rupture the space of eight years, which however did not give him much trouble; but on a sudden the hernia swelled with a considerable hardness, which the surgeons in vain attempted to remove, by the application of emollient cataplasms. At length the tumour suppurated, and being opened, the surgeon amputated part of the intestine, which was putrefied to the length of four fingers breadth; afterwards a portion of the same length separated spontaneously. When it was now believed by every body, that an opening would remain in this place, which would perform the office of an anus during the patient’s life; yet beyond all expectation the discharge of humours from the wound grew less, and the patient was cured within the space of thirty-three days, and lived afterwards perfectly in health^b. We are still more evidently taught by another case, that an intestine which has been totally divided may unite together. In a man afflicted with a rupture, part of the intestinal tube, to the length of six inches, was destroyed by a gangrene. A thread being passed through that part of the mesentery to which the corrupted intestine adhered, both ends of the intestine were by that means retained in the mouth of the wound, with a view that they might adhere to the margin of the wound, and that the upper end of the

^a Aphorism. 24. Sect. VI. Charter. Tom. IX. pag. 261. & in Coacis Prænot. numb. 503.

^b Academie des Sciences l’an 1723. hist. pag. 41, &c.

intestine might perform the office of an anus, the other end remaining useleſs: but in a month's time the two ends ſo united, beyond all expectation, that the ingeſted aliments were diſcharged again, by their common courſe, through the anus; ſo that the man recovered, only with this inconvenience, that if he eat much, he was troubled with the colic, which began at the part wounded, and grew leſs upwards. This ſeems to have been the conſequence of a ſtricture in the inteſtinal tube, which was not only narrower, but of a more compact ſubſtance, and leſs able to yield, where the two ends were united^c. This is alſo confirmed by another remarkable inſtance. Ramdohrius, ſurgeon to his Serene Highneſs the Duke of Brunſwick, removed a conſiderable part of the corrupted inteſtine, in a woman who had an incarcerated rupture, which broke ſpontaneouſly; he afterwards introduced the upper end of the inteſtine into the lower, and having conjoined them by a ſlight ſuture, replaced them into the abdomen. This woman being thus ſnatched from the jaws of death, lived afterwards in health; but being taken with a pleuriſy, ſhe expired in about a year from that time, and upon opening her body, the ends of the inteſtine appeared to have well united together. This inteſtine, together with part of the abdomen to which it adhered, is now kept by the celebrated Heiſter^d, to whom it was given as a preſent by an expert ſurgeon.

But it is very evident, that ſuch an union of the divided inteſtine will not follow, if the two ends are left fluctuating in the abdomen; but for this purpoſe it is required that they remain in contact with each other, by adhering to ſome adjacent part; and therefore this union more frequently happens in ruptures, becauſe the extremities of the inteſtine, coming thro' the ring of the abdominal muſcles, folded together,

^c Ibidem, pag. 44.

^d Inſtitut. Chirurg. part. II. cap. 117. pag. 818.

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remain in contact with each other, as it is beautifully demonstrated and illustrated with figures by the celebrated Morand ^c, who has very reasonably deduced the manner of concretion, and the other consequences thence arising from the structure of the parts. It is in the same place proved, that the capacity of the intestinal tube is always less in the part where it is joined, which the same author testifies he has frequently seen after death in the bodies of those, who have been afflicted with these disorders. On this account therefore, if the patient does not abstain from the more compact food, and eat in small quantities at a time, there will be danger of an obstruction at the stricture, whence follow the most acute pains, and often a rupture of the part tho' long conjoined; of which we have an instance in a woman, who expired from this cause many years after she had been perfectly cured, in whose abdomen both the ingested aliments and medicines were found discharged by a rupture of the intestine in that part, where its two divided ends had united ^f.

But when there are no hopes that the divided ends of the intestinal tube can be united with each other, the only method that then remains is to conjoin the upper end of the intestine by suture to the margin of the external wound; where it sometimes naturally tends, or is cautiously conducted by art, to serve as an artificial anus during life; while the other end, being tied with a ligature to prevent its present contents from escaping into the abdomen, remains ever afterwards useless. And in this manner may life be preserved, if the length of the intestinal tube from the pylorus to the artificial anus be sufficient to absorb chyle enough from the ingested aliments to supply the blood, for repairing those losses which are made in the substance of the body by the continual actions of life. But in order to know which of the two extremities

^c Acad. des Sciences l'an. 1735. Mem. pag. 335, &c.

^d Ibid. pag. 376.

belongs to the upper tract of the intestines continued to the pylorus, take the signs delivered by the celebrated Littre^s: for the upper extremity will have an apparent vermicular motion, the matter of the chyle will pass alternately through that extremity, the sides of which will not appear entirely collapsed, or if they do sometimes collapse, they will be soon after elevated by the matter contained in the cavity of the intestine protruded there. But in the other end of the divided intestine, which is continued to the rectum, there will be no peristaltic motion, nor any thing discharged from thence, unless in the beginning, or when something is forced out by a convulsive and retrograde motion ascending from below upwards; and which never follows so regularly, as it may be discerned in the upper extremity. That extremity being found which is continued to the duodenum, the surgeon then divides its circumference in three places, and unites it by suture to the margin of the wound; or else by passing threads through the end of the intestine, retains it in the mouth of the wound, till it there conjoins. Thus may life be preserved by art, but not without a very foul inconvenience, since the fœces must pass this way so long as the person lives. It sometimes happens, that the upper extremity of the divided intestine conjoins with the mouth of the wound by the assistance of nature only. Thus M. Mery^h cut off above five feet in length of a mortified intestine in a maid of twenty-eight years old, following an incarcerated rupture; and the upper orifice of the intestine adhered afterwards to the inguen, where the fœces were discharged during the remainder of life; and they were sufficiently hard and figured, when she took food of easy digestion and in moderate quantities. Many such cases have happened after a battle, when soldiers rush upon the enemy with their bayonets fixt upon their muskets, whence frequently

^s Acad. des Sciences l'an 1700. Mem. pag. 394.

^h Ibid. l'an 1701. pag. 372, 373.

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 follow very bad wounds of the abdomen, attended with a division of the intestines. I remember to have seen a soldier about twenty years ago, in whom the intestinum colon adhered to the external orifice of the wound after it had been divided in this manner; and as he begged alms, he readily permitted the intestine to be examined, which adhered with some part of it hanging out, so that one might very well examine the surface of the intestine. It was then ten years since he received the wound, and he seemed to enjoy a perfect state of health.

S E C T. CCCXVIII.

IF the omentum is prolapsed and appears as yet moist, warm, and reddish with the circulating blood, it is to be replaced as before (316).

Hippocrates says ^h, *si omentum excidat, necesse est putrescere*; “That if the omentum prolapses through a wound, it must necessarily corrupt or mortify.” Certain it is, that the tender fabric of the omentum cannot be long exposed to the cold of the external air, without a considerable injury of the vital circulation of its juices, which is sometimes totally destroyed by the same means; and therefore it ought to be replaced immediately if it is possible. But it must be observed, that the membrane of the omentum is so thin, that it will not bear to be roughly handled without laceration; and therefore the greatest circumspection must be used in replacing it; for otherwise, by breaking the small vessels of the omentum in a rough reduction of it, the consequences may be inflammation, suppuration, a gangrene, and a train of the worst maladies. For this reason therefore the wound ought rather to be dilated, that the omentum may be replaced without violence. The moisture,

^h Aphorism. 58. Sect. VI. Charter. Tom. IX. pag. 289.

warmth, and red blood, visible in the small vessels of the omentum, denote that the vital motion of the juices still continues in the part which is prolapsed through the wound.

S E C T. CCCXIX.

BUT if the omentum appears dry, cold, or livid, it is to be first treated with fomentations, or else removed by incision before it is replaced.

But when the omentum has lain a considerable time out of the wound, it usually mortifies, and that in a very short time; which may be known from its coldness, dryness, and livid or black colour. It would be dangerous to return a part thus mortified into the abdomen; for by its separating afterwards from the living parts, it would putrefy in that cavity, and infect all the adjacent viscera: upon which account Celsus^a advises to consider the state of the omentum after the intestines have been returned into the abdomen: *Ex quo, si quid jam nigri & emortui est, forcice excidi debet; si quid integrum est, leniter super intestina reduci;* “That if any part of it is already black or
“mortified, it must be cut off with a pair of scissors;
“and if any remains sound it may be gently returned
“over the intestines.” But if notwithstanding the change of colour, there remain some hopes that the life of the part may be recovered, let it be treated with emollient fomentations, and especially by the application of live animals slit open; and when the signs of life appear again, to wit, moisture, warmth, and redness of colour, it is then to be returned into the cavity of the abdomen, or else what is mortified must be cut off. There are however some celebrated surgeons, who return the omentum if it only appears li-

^a Lib. VII. cap. 16. pag. 453.

Sect. 319, 320. Of Wounds in the ABDOMEN. 89
vid in a small degree; and they affirm, that no bad consequences have followed from thence^b: for then life easily returns into this part by the natural heat of the body. But when the mortified part of the omentum is to be extirpated, a thread is first passed round the sound part, and then tied, for cutting off what is mortified under the ligature, at about the distance of a finger's breadth from it; the remainder is then returned into the abdomen, taking care that a sufficient length of the thread may hang out of the wound, that it may be conveniently extracted after the separation is made. Nor has there any great inconvenience been observed to follow after a part of the omentum has been thus extirpated. Galen^c indeed tells us, that a part of the omentum being lost, renders the stomach colder and less apt to make a good digestion; and affirms, that he has seen a certain gladiator, who had lost almost the whole omentum by a wound, and he was afterwards obliged continually to wrap up his abdomen with flannels to avoid injury from the external cold. But it is evident from numberless observations since made, that this accident has not followed a loss of the omentum^d; upon which account it would seem, that it may be safely extirpated, which is also confirmed, because we frequently observe a great part of the omentum wanting in dead bodies, notwithstanding the functions of the abdominal viscera have been duly performed in those persons.

S E C T. CCCXX.

PLentiful bleeding, with the injection of clysters in the beginning when the large intestines are uninjured, a proper regimen of diet, a

^b Dionis Cours d'Operations de Chirurgie demonstrat. 2. pag. 73.

Garengot Traité des Operations de Chirurgie, Tom. I. pag. 120.

^c De usu part. Lib. IV. cap. 9. Charter. Tom. IV. pag. 377.

^d Acad. des Sciences l'an 1725. hist. pag. 13.

quiet respiration with rest, and a proper posture of the body, are here the principal remedies.

From what has been hitherto related, several general methods of relief are deduced, which have been always found highly serviceable in the most dangerous wounds of the abdomen; these are,

Bleeding.] Nothing is here more to be feared than an inflammation of the abdominal viscera, which speedily tending to a gangrene, after the most excruciating pains, often kills the patient in a very little time; but herein we have the most relief from plentiful bleeding, which usually removes the present inflammation, and prevents the future. Thus in the incarcerated rupture scarce any remedy succeeds, unless the strength be weakened by a very bold repetition of phlebotomy, so as to restrain the too great impetuosity and inflammatory motion of the vital powers.

Clysters, &c.] If the large intestines are injured, it is very evident, that clysters will be pernicious by escaping into the cavity of the abdomen; but if they appear to be entire, then clysters will be extremely serviceable, by discharging the hard fœces of the large intestines; that the patient may not be afterwards obliged to strain violently upon the stool for their expulsion. For in evacuating the bowels, the diaphragm is pressed downward by the inspired and retained air, and the abdominal muscles acting at the same time, very strongly, compress all the parts contained in the abdomen, which will therefore press upon the part wounded, so as to force out either the omentum or intestines, or else lacerate or break open again that which lately began to heal: whence the usefulness of clysters in wounds in the abdomen is sufficiently evident.

Diet.] It was said before, under the cure of wounds in general, in § 192. that those aliments are chiefly serviceable to those who are wounded, which are of a mild nature and easily digested or assimilated, with-

out being apt to putrefy, provided they are taken often and in small quantities at a time. But in wounds of the abdomen it must be also considered, that the action of those viscera is often injured, which ought to have the greatest share in changing the crude aliments so effectually, that they may be afterwards capable of forming part of ourselves by the action of the lungs and vessels; at the same time also it must be observed, that a large quantity of aliments taken at once will immediately distend the stomach and intestines; whence it is evident, that great caution is required in managing the diet. But it will be also of the greatest use here to give such aliment as leaves the least quantity of gross fœces in the intestines; since straining upon the stool, after all the fœces have been first discharged by a clyster, ought to be avoided as much as possible. All these intentions are answered by nothing better than the use of broths of the flesh of young animals; for if three or four ounces of them be taken every two hours, mixed with a little citron juice to prevent them from degenerating too easily into a putrid state, life will then be supported with little or no action of the stomach and intestines to change these aliments; and at the same time very few or no fœces will be collected in the intestines, so that the patient may remain without going to stool for several days or even weeks without detriment. Toasted bread may be soaked or boiled in these broths, provided it be afterwards taken out to avoid increasing the quantity of fœces in the large intestines: and as for drink, mere water, with the addition of a little wine, will be sufficient; but a decoction of bread, barley, or oats, or even soft ale, may be sometimes allowed. Milk, if not its whey, is to be here avoided; because it leaves too large a quantity of gross fœces, as we see evidently in infants, who frequently discharge very thick and gross fœces, though they only suck the milk of their mother.

Quiet respiration, rest, and posture of the body.] For at every inspiration the abdominal muscles are distended, and contracted again at the time of expiration, by which means the contents of the abdomen will be alternately compressed; therefore the quieter the respiration, the less will the wounded parts be agitated, and the more easily united. For the same reason too rest is here very necessary; but the posture ought to be that in which the patient may remain with the most ease, namely, with the body placed a little erect upon a couch, or sitting nearly in the same posture, with the orifice of the wound inclined as much as conveniency will permit, that the blood, matter, and other humours may have a ready discharge, without being collected in the cavity of the abdomen.

These are the means proper to be used in all wounds of the abdomen, as also after cutting for the stone, or a fistula of the anus; for unless the patient be not obliged to strain upon the stool in those disorders, the very worst consequences may follow, though the operation has been happily performed. It is also evident from observations, that the most desperate wounds of the abdomen, attended with the worst symptoms, have been happily cured by this method. It will be sufficient for us at present to produce only one instance, which we have already mentioned once before upon another occasion in the commentary on § 170. numb. 5. A mad-man inflicted eighteen wounds in his abdomen, eight of which penetrated its cavity and injured the contained viscera. The violent fever, tension of the abdomen, difficult and painful respiration, nausea, vomiting, diarrhoea, &c. afforded a severe prognosis, insomuch that he was almost given over. Phlebotomy was repeated seven times in the four first days, the diet was very thin, composed almost entirely of flesh broths, with the addition of lettuce, succory, purslain, and the like mild pot-herbs; perfect rest was procured

procured with lenient and diacodiate emulsions; and by a careful and seldom dressing of the wounds with those means, the patient not only recovered from so many wounds, but became perfectly well both in body and mind. Seventeen months after this he became mad again, and threw himself from a high precipice, by which he was instantly killed; and on opening the body, the cicatrices which appeared demonstrated, that the middle lobe of the liver had been wounded, as also had been the intestinum jejunum and the colon^a. This history demonstrates how much we may expect from this method in the most dangerous cases.

Of CONTUSIONS.

S E C T. CCCXXI.

IF a hard and obtuse body does by its motion, resistance, biting, or pressure, break or lacerate many small vessels at the same time, that injury is termed a contusion.

A contusion is a solution of continuity made in any part of the body by a hard instrument, whose surface does not terminate either in a point or edge, but in some obtuse figure; for by this it is distinguished from a wound, which is a solution of continuity made by a wounding or sharp instrument. Hence a contusion is always (*cæteris paribus*) larger, or occupies a greater space than a wound, because the contusing instrument is applied to a larger surface of the body. It now therefore is very evident, that the effect will be the same, whether the obtuse body in motion strike upon a part of the human body, or whether a part of the human body in motion be forced against a hard obtuse and quiescent obstacle, or

^a Acad. des Sciences l'an 1705. Mem. pag. 40, &c.

94 Of CONTUSIONS. Sect. 321, 322, 323.
whether the obtuse body presses upon the part by its own weight, or by pinching crushes any part.

S E C T. CCCXXII.

THE idea of which is an assemblage of little wounds with a crushing of the solid fibres and vessels.

There may be so many small wounds conceived in the contusion as there are injured parts within its circumference, so that an assemblage of small wounds close to each other gives the whole idea of a contusion: thus for example, if an artery be divided by a razor, it is a wound; but if it is divided by an infinite number of incisions very close to each other, it will in a manner represent a contusion of such an artery. But the more solid, hard, and resisting parts are usually broke or ground into very small fragments; as for example, when the bones of the arm are by any cause broke in two, it is termed a fracture; but if they are crushed into small fragments, it is denominated a contusion.

S E C T. CCCXXIII.

THE effects are therefore a solution of continuity with laceration, a destructive crushing of many fibres and vessels at the same time, an extravasation of the juices into the adjacent vacuities, which are either there naturally seated, or made by the accident, with an infinite number of maladies which may follow from thence. A mortal emphysema, following a fracture and contusion of the ribs, may be seen in Mem. Acad. l'an 1713. pag. 119.

A solution of continuity with laceration.] A laceration is when the soft parts of the body are ruptured by distracting, and this distraction being present in all contusions distinguishes them from wounds, in which there is also a solution of the continuity, but without that laceration, since a wound is inflicted by a sharp instrument. A wound may indeed be joined with contusion, but then it is a compound disorder.

A destructive crushing, &c.] A wound being attended with a simple division only of the parts, which before cohered, gives an opportunity frequently for a happy cure, even in the largest wounds, by a concretion of the divided parts brought again into contact. But in a contusion the parts are so ground to pieces, that their vital fabrick being destroyed, it is impossible for them to unite again with the parts adjacent; and this makes a separation of them all necessary in order to a cure; because being deprived of all the vital influx of their juices, they are now dead, and are to be considered as foreign bodies interposed betwixt the living parts, which are thereby prevented from uniting with each other. Hence Hippocrates^a justly pronounces, *Carnes contusas necessario in pus versas tabescere*; “That contused flesh “being converted into matter, must necessarily be “destroyed or wasted.” Therefore he would have a suppuration to be speedily procured in this case.

An extravasation of the juices into the adjacent cavities, &c.] The vessels being ruptured, their contained juices are then extravasated and deposited in foreign parts. Even Hippocrates^b has been bold enough to pronounce, that the whole body is full of cavities, *Omne enim non concretum, sive cute, sive carne tegatur, cavum est. Impletur autem sanum quidem spiritu, egrotum vero ichore*; “For all that is not con- “creted or solid is hollow, whether it be covered “with flesh or skin. The cavity is indeed filled with

^a De ulceribus, cap. 2. Charter. Tom. XII. pag. 131.

^b De arte, cap. 8. Charter. Tom. II. pag. 150.

“ air in a healthy state, but in a diseased state with “ ichor.” Therefore the extravasated humours will every where find a passage into these smaller or larger cavities of the body. For there is scarce any vessel, muscle, tendon, or even fibre in the whole body, but what is invested with a membrane very easily dilatable, and composed of many cells communicating with each other: the small cells or cavities therefore of this membrane are dispersed through every part of the body, and may be filled with the juices extravasated from the ruptured vessels. But for the larger cavities of the body, such as the ventricles of the brain, the cavity of the thorax, of the vesicles, trachea, and bronchia of the lungs, with the cavity of the pericardium, abdomen, stomach, &c. these are sufficiently known. But the extravasated humours may not only fill these larger or smaller cavities, which are naturally in the body, but they may be also there accumulated, and by distending or removing the parts which were before contiguous, they may either make new cavities, or else greatly increase the magnitude of the natural cavities; as for example, after a violent contusion of the head, the vessels of the dura mater being ruptured, the blood extravasated and collected betwixt that membrane and the skull, may separate the dura mater from the cranium, to which it before strictly adhered; and thus will a new cavity be formed, which was not there before.

With an infinite number of maladies, &c.] All the maladies which follow from contusion are reducible to three heads; for they either arise from a rupture of the solids, and an extravasation of the fluids, which destroy the functions resulting from the determinate motion of the juices through the entire vessels; or else they follow from the pressure of the extravasated humours, collected in some natural or preternatural cavity of the body, and by their weight or bulk disturbing or abolishing the functions of the adjacent

jacent parts; or lastly, they follow from the putrefaction of the stagnating and extravasated juices, which may acquire an acrimony sufficient to corrode and destroy the circumjacent parts. If now these three circumstances are applied to every particular part of the body, it is evident, that an infinite number of maladies may thence follow, which it would be impossible to enumerate, and therefore it is sufficient for me to have pointed out their general sources. The instance which is here referred to in the Mem. R. Acad. S. teaches us, that violent contusions may be frequently attended with surprising symptoms, not easy to be foreseen by the most skilful in the profession. A man of sixty years of age had his ribs fractured and contused by the wheels of a chariot running over his breast, so that a fragment of a rib slightly wounded the external membrane of the lungs, whence part of the inspired air escaping by the wound into the cavity of the thorax, insinuated itself into the cellular membrane, and inflated almost the whole surface of the body with a surprising emphysema, infomuch that the miserable patient was suffocated on the fourth day after the accident. ^c Parey has formerly observed such a flatulent tumour formed about the ribs after contusions; but he does not seem to have well understood the cause. There are many other instances to be met with in the writers of observations, which teach, that a violent contusion has frequently wounded or separated the liver, spleen, *etc.* without any apparent injury in the external parts, whence sudden death. Even sometimes a violent contusion has been observed to produce sudden death, though no considerable injury could be observed either in the external or internal parts. See what has been said upon this subject, in the commentary on § 274. A remarkable case of this nature is related in Bohnius^d, of a man who was struck by a stone of several

^c Liv. XII. chap. 6. pag. 293.

^d Derenunciacione vulnerum, pag. 17.

pounds weight, which was violently flung against the right hypogastrium, whereupon he suddenly fell down and expired. When Bohnius examined the dead body by order of the magistrate, he found no injury either in the integuments, viscera, or vessels, only the diaphragm was a little contused and livid, in that part of the same side where it is contiguous to the false ribs, but the whole compass of the bruise was scarce equal to half a crown.

S E C T. CCCXXIV.

BUT the worst of these cases (323) is, when the internal parts are so injured (321, 322, 323), the integuments remaining entire, that the juices stagnate, congeal or putrefy; whence an ecchymosis, a spurious aneurism, a black or blue spot, an ulcer, gangrene, or mortification; and in the glands, a scirrhus or cancer.

The skin being tough and very cohesive, is not so easily ruptured by an obtuse instrument; but the vessels running through the panniculus adiposus, placed under the skin, are much more tender and more easily broken. Thus if any one should receive a blow with a hammer upon the finger, the skin will generally remain whole, but yet a black spot will deform the contused part by an extravasation of the blood from the ruptured vessels under the entire skin; and this more especially happens if the subcutaneous vessels are forced by the contusing body against any subjacent hard bone; for which reason it is, that such large tumours so suddenly arise, when the head is struck against some hard obstacle. But the juices thus extravasated from the ruptured vessels, and confined by the entire skin, are collected in the cellular membrane, where they stagnate, and therefore congeal; and where they may at length putrefy, though but slowly,

slowly, if no access be given to the external air. Various bad consequences may from hence arise, the principal of which may be referred to those that follow.

Ecchymosis.] This is an extravasation of the juices from their vessels under the integuments, a definition of which is given us by Ægineta^a: *Carne contusa a quodam gravi illapso, et parvis in illa venulis divulsis sanguis profunditur per diapædesin: qui, ubi colligitur sub cute, facit illud, quod vocatur ecchymoma. Non divulsa cute sic ut tumor mollis tactui cedens sequatur, lividus et indolens at plurimum*: “The flesh being contused by
“the stroke of some heavy body, and the small vessels therein ruptured, their blood is then extravasated *per diapædesin*, and being collected under the
“skin, forms what is called an ecchymosis. Thus
“the skin not being divided, a soft tumour is formed, which yields to the touch, and is generally livid, and without pain.” And thus Galen^b says, that an ecchymosis is when the blood is extravasated from the vessels into the circumjacent spaces; and in another place^c, that when the contused flesh extravasates its blood in a part under the skin, the disorder is termed (*ἐκχύμωμα*) a suffusion.

A spurious aneurism.] That is, when a large artery being injured, discharges a considerable quantity of blood into the panniculus adiposus, where it is collected under the skin; concerning which, see the commentary on § 178. So that a rupture of the smaller vessels, extravasating but a small quantity of blood under the skin which remains entire, the disorder is then termed an ecchymosis; but when the skin is distended with extravasated blood, from the rupture of a considerable vessel, it is termed a spurious aneurism.

^a Lib. VI. cap. 30. pag. 66. versa.

^b In Commentar. in Aphor. 20. Sect. VI. Charter. Tom. IX. pag. 259.

^c Commentar. 3. in librum Hippocrat. de Medici officina, text. 31. Charter. Tom. XII. pag. 98.

A black or livid spot.] When the pressure of the atmosphere on the surface of the body is either diminished, or wholly removed from any part, either by sucking, the application of cupping-glasses, or the like; the blood then rushes into the vessels of the part less pressed, and distends them, so as to enter many of the smaller dilated vessels, which did not naturally contain any red blood, and the red parts being impacted in these vessels without being able to return, give the appearance of a red, livid, or often of a blackish spot. Such a spot being formed in any part by suction, the part is said to be blood-shot; but when a part, being struck with a hammer, has its blood-vessels suddenly compressed by the stroke, then also the blood may be forced into the lymphatic or serous vessels, and by changing their colour, may produce a very considerable spot of this kind. Blood-shot therefore differs from an ecchymosis, in as much as the blood is strongly pressed into the serous vessels without any rupture in the former; but in an ecchymosis, the vessels being ruptured, the blood is extravasated into the adjacent spaces; whence the former of these takes place, rather about the circumference, than in the middle of the contused part. But it is very evident, that both blood-shot and ecchymosis may both of them follow after violent contusions, whence they are frequently confounded by authors without distinction.

Ulcer and gangrene.] That is when the extravasated humours corrupt by stagnating, and inflame or erode the adjacent parts. Even sometimes the circulation is stopt, by too great a distention of the cellular membrane with the extravasated juices, whence a gangrene and mortification may follow.

Caries.] That is, when the forementioned injuries extend to the substance of a bone.

In the glands a scirrhous or cancer.] Since it is evident from anatomy, that the glands are composed of innumerable small arteries, by the different disposition

sition of which a thin juice is separated from the arterial blood, and being collected, is afterwards discharged by an excretory duct; it is therefore evident, that a contusion of the glands may so injure their small vessels, and compress or obstruct their emissaries, as to deny a free passage to the humours separated by the arterial fabrick; whence a stagnation, and the more fluid parts of the juices being either exhaled or else absorbed by the small veins, an inspissation of the secreted juices follow, and forms a hard, indolent, and almost irresolvable tumour, which we call a scirrhus; which scirrhus becoming inveterate, extremely hard, knotty, and accompanied with pain, is then termed a cancer.

S E C T. CCCXXV.

A Contusion also frequently injures the bones, and then follow all the symptoms before described (249, 250, 251, 254, 256, 257), with an injury of the medulla; whence ulcers, fistulæ, caries, and putrefactions within the bones; for the medulla in the bones, will be thence affected like the brain in the skull, as at (273, 274).

When a contusion has extended itself into a bone it may compress or rupture the vessels which run betwixt the component lamellæ of its substance; whence the vital circulation of the juices in the lamellæ is destroyed, and they therefore mortifying, must be exfoliated, or cast off from the subjacent living parts of the bone. But this disorder may by degrees spread itself through the whole substance of the bone, in the manner explained before under the aphorisms here cited, treating of the several injuries of the bones of the skull.

An injury of the medulla, &c.] This is an accident the most of all to be feared in contusions of the bones; for the marrow is lodged within the cavities of the larger bones, and there is a like substance interspersed betwixt the cells or spongy parts of the bones. But as the brain is defended with a bony covering, so the medulla lies secured within the cavity of the bone; and as the brain is covered with a peculiar membrane, called the pia mater, which receives and distributes the vessels entering its substance; in the same manner also is the medulla invested with a fine vascular membrane, for the same uses. The arteries of the pia mater, having deposited their thicker coats, appear very thin; and the same is also true, in the arteries which are extended to the substance of the medulla: so that the marrow taken out of the thigh bone of an old ox, may be easily pressed into a mere oil betwixt the fingers, notwithstanding it appears to be furnished with innumerable arteries. Also as a fissure, fracture, or contusion of the skull, may communicate its disorders by the corrupted or extravasated humours, so as to infect the brain itself; so likewise an injury in a bone may be extended to its medulla. A violent concussion of the head may rupture many of the small vessels of the encephalon, while the skull remains entire; and it is very evident, that the same may also happen to the medulla, if a bone which contains marrow is violently struck by a blow. Now when the tender vessels of the medulla receive the disorder from the investing bone, or are injured by any other cause, the medullary oil, extravasated from the ruptured vessels, stagnates, and thereby acquires a most malignant and rancid acrimony, so as to erode all that it touches, and render the bone itself carious; whence follow most malignant and almost incurable ulcers, with obstinate fistulæ, not to be cured, unless the parts can be cleansed from the corrupted medulla. From this malignant erosion, by the putrid oil, follow a destruction

tion of the parts, with an infinite number of other disorders, of which we shall treat hereafter, in the diseases of the bones, at § 526.

S E C T. CCCXXVI.

AND sometimes the muscles are also injured in like manner by contusions, whence large abscesses or suppurations, gangrene, palsies, or a stiffness or contraction: but if the contusion destroys large nerves which distribute many branches, it then certainly produces a palsy, a withering, insensibility, or a gangrene of the parts below, not to be cured by any art; but this is more especially true of the *spina dorsæ*, and its contained medulla.

Muscles.] It appears from the modern anatomy, that any visible muscle may be divided into smaller bundles of muscular fibres; nor have we hitherto been able to find out the extent of this division, even though assisted by microscopes: for no one has been ever yet able to see a single muscular fibre, but always several fibres appear collected together. These fasciculi of muscular fibres are invested with a thin cellular membrane, which contains a subtile oil for lubricating those fibres. But the small arteries are very numerously dispersed betwixt the interstices of those fasciculi, within the cellular membrane, as the injections of Ruysch demonstrate, insomuch that they seem to constitute almost the whole substance of the muscle. These arteries are likewise accompanied with similar small veins, as also with nerves, throughout the whole substance of the muscle. A contusion of a muscle may therefore break these vessels, and extravasate their juices in the cavities of the cellular membrane, where being collected, they may compress the adjacent vessels. The extravasated juices may be also corrupted,

rupted, and by their acquired acrimony, they may corrode the parts within their contact; whence inflammation, suppuration, gangrene, and the rest of the disorders that may thence follow. But suppurations arising from this cause are the worst of any, because the matter formed in the thin cellular membrane, which invests the muscular fibres, will make itself surprising passages, so as to run through all the tracts of this membrane, forming fistulæ and sinuses of the worst kind. Add to this, that the cellular membrane being consumed by a long suppuration, may give occasion for the fasciculi of muscular fibres, which it distinguished from each other, to grow afterwards together; whence the free motion of those fibres will be impeded, in their distention, by those causes which move the muscle, by which means the action of the muscle itself will be either depraved, or totally destroyed. Also the muscular fibres themselves, strictly so called, may be destroyed by a violent contusion; whence the muscular motion will cease, which depended upon the continuity of these fibres, and the muscle will become paralytic, which is an inability of any muscle to motion, with a flexibility and laxity of the affected muscle. But also a contraction of the limb may from thence follow, when the cellular membrane, which distinguishes the muscular fibres, being destroyed by a violent suppuration, occasions the fibres to grow to each other, so as to intercept the influx of their thinnest juices; whence a gradual contraction or shrinking of the muscle, which can be no more elongated by any distracting power, and from thence may arise surprising contractions, or distortions of the limbs; which may also proceed from the action of any muscle being destroyed, while the action of its antagonist prevailing, continually draws the limb towards its origin, where it at length stiffens: hence it is that a contraction of a limb so frequently follows an inveterate palsy.

But when muscular fibres are ruptured by a contusion, without destroying the action of the muscle, it seems then to produce that very painful disorder which the antient physicians called (*σπάσμα*) a pulling, or (*ρήγμα*) a rupture. Galen ^a, treating of a contusion, says, *Manifestum autem, quod parvæ venæ una cum carne dividuntur in suffusionum (ἐκχυμωμάτων) generatione. Vulsiones (σπάσματα) autem fiunt circa fibras musculorum amplius distentas, ut nonnullæ rumpantur, et vocant proprie juniores Medici hos affectus rupturas (ρήγματα).* Horum autem primus Hippocrates meminit, etc. “ But it is manifest, that the small vessels “ are divided together with the flesh, in the formation of contusions (*ἐκχυμωμάτων*.) But contractions “ (*σπάσματα*) are made upon the fibres of the muscles which are most distended, so that some of “ them are broke; which disorder is properly called “ by some of the younger physicians (*ρήγματα*) ruptures. But among these Hippocrates is the “ first that remarks, &c.” These ruptures are thus described by Hippocrates, ^b *Quibusdam autem, cum imbecilles in carnibus aut venis vulsiones factæ fuerint, non suppurantur, sed diurni fiunt dolores, & vocant rutiones (ρήγματα):* “ But some people having a weak “ distention in the flesh or small vessels, a suppuration does not follow, but lasting pains are produced “ which are called (*ρήγματα*) ruptures.” And in the end of the same chapter he adds, *Fiunt enim vulsiones à laboribus, et casibus, et à plaga, et si quis onus majus tollat, et à cursibus, et ludâ et ejusmodi omnibus:* “ For contractions arise from hard labour, from accidents, and from wounds, or when a person lifts “ too great a weight; as also from running, wrestling, and all such like motions.” He seems also to have spoke of this in his *Prænotiones Coacæ* ^c,

^a Commentar. 3. in librum Hippocrat. de Medici officina text.

³¹ Charter. Tom XII. pag. 98.

^b De morbis, Lib I. cap. 8. Charter. Tom. VII. pag. 541, 542.

^c No. 425. Charter. Tom. VIII. pag. 877.

where he says, *Vulsiones omnes quidem molestæ sunt, et dolores in initio intensos producunt, et in posterum aliquos commonefaciunt, difficillimæ autem circa thoracem et maxime periculosæ*: “ That all distractions are un-
 “ easy, and at first produce intense pains, but after-
 “ wards they give but slight uneasiness, being very
 “ obstinate, and the most dangerous about the tho-
 “ rax.” But it must be observed, that in the translation they have rendered (*σπάσματα*) *convulsiones*, improperly; since these are called (*σπάσμοι*). But Galen^d observes to us, that the muscular fibres thus divided are very difficultly conjoined again; for it was his opinion, that the ruptured fibres would easily enough unite, if the ecchymosis was speedily dispersed; but when that continued a long time, then the foul humours collected betwixt the ruptured fibres interposed, and obstructed them from uniting; so that from the great fatigue, fever, and less perfect digestion of the aliments with such like causes, the pain returned again. Perhaps there may be something of this nature in the muscles after violent straining, in lifting up great weights, &c. For severe and sudden pains then arise, which frequently torment the patient for a long time, and are exasperated by the least motion of body. Certain it is from experience, that an absolute rest of body is the chief remedy in these pains: and Hippocrates^e directs, for the cure of these ruptures or distractions of the muscular fibres in the thorax, that the patient must abstain a year from labour; and in another place^f, after saying that this disorder arises from immoderate labour, he observes, that rest of body is highly necessary; otherwise the disease will return, and torment the patient worse than at first.

^d Method. Medend. Lib. IV. cap. ultimo. Charter. Tom. X. pag. 102.

^e De Morbis, Lib. II. cap. 24. Charter. Tom. VII. pag. 576.

^f De Internis affectionibus, cap 9. Chart. Tom. VII. p. 644.

But if large nerves, &c.] If we consider the nerves in their origin, at the medulla oblongata and spinalis, they evidently appear very soft; and if the extremities of the nerves be also considered, in those parts where they deposite their integuments to form a sensitive organ, for conveying ideas to the mind by the new changes or impressions made upon them by external objects, how tender do they there appear! This is evidently demonstrated by the pulp of the auditory nerve, and in the retina of the eye, which last immediately collapses into a shapeless mucus, if it is not sustained by the equable pressure of the ambient humour. But these tender nervous threads are safely conveyed from their origin, to the extreme parts of the body, under the defense of tough coats and integuments. If therefore a large nerve should be contused in its course, the soft pulp-like substance of it may be injured, or even destroyed, while the integuments of the nerve appear uninjured; from whence all those functions will be destroyed, which resulted from the sound structure of the several smaller nerves, collected together in the large one. This appears evident in the experiment of Valsalva, mentioned in the commentary on § 276. numb. 5. - For when he made a strict ligature with a thread upon the cardiac nerves of a dog, and removed the ligature soon after, the animal perished in a few days time, in the same manner as if these nerves had been divided, and yet there was no sensible injury appeared in the nerves, after death. For in this case the ligature so compressed the soft and pulp-like substance of the nerves, that the free influx of the spirits through them was wholly intercepted.

But why an incurable gangrene follows the destruction of a large nerve, and especially from an injury of the spinal medulla, we have already declared in the commentary on § 162, where some remarkable cases are alledged for confirming this doctrine.

S E C T. CCCXXVII.

EVEN a contusion frequently destroys or crushes the viscera themselves; and then follow an inflammation of them, a suppuration, a gangrene, scirrhus, and an injury of their functions.

What bad consequences sometimes follow after violent contusions of the head, by which the brain itself is injured, has been already observed in the history of wounds in the head. The viscera contained in the cavity of the thorax, are on all sides securely defended by the arched ribs, the sternum, and spina dorsi; and yet the wonderful case related at § 323, demonstrates, that even these viscera may be sometimes injured by contusions, since a fragment of the ribs lacerated the external membrane of the lungs, and produced a surprizing emphysema, with death itself. But the abdominal viscera are more liable to be injured by contusions; since they are for the most part covered only by the soft integuments and muscles of the abdomen; and though the spleen and the largest part of the liver are defended by the false ribs, yet have these viscera been sometimes so violently crushed by contusions, that death itself has speedily followed, as appears from the observations related at § 170. numb. 3. Nor will this appear wonderful, if it be considered that the substance of the liver and spleen is so tender, that unless great caution be used, they cannot be taken whole out of the dead body; from whence it is, that violent contusions of the abdomen so often prove fatal, in a small space of time. Parey^a relates, that two boxers fighting, one of them being of a small stature, but thick and strong, forcibly threw down the other, who was very tall;

^a Oeuvres d'Ambroise Pare. Apologie & Voyages, pag. 783.

whereupon

whereupon the tall one being enraged, took his elbow, and pushed it with the whole weight of his body against the scrobiculum cordis of his adversary, whereby the unhappy man instantly stretched out and expired. A large quantity of extravasated blood was found in the cavity both of the abdomen and thorax. There are innumerable observations to be met with in authors, from whence it appears that several of the viscera have been so injured from violent contusions, that death, and the worst consequences, have thence followed. For by this means the vessels may be ruptured, and their contained juices extravasated, which by putrefying may corrode all the adjacent parts; whence again may follow the very worst consequences, as inflammation, with all its attendants; namely, a suppuration, gangrene, &c. And since the functions of all the viscera depend upon the continuity of their vessels, and the regular motion of the juices through them, it is again evident, that those functions may be injured, or even totally abolished by contusions.

S E C T. CCCXXVIII.

FROM hence (332 to 328,) it is easy to explain the many surprising and miserable symptoms and disorders, which usually follow from contusions (321); and an infinite number both of acute and chronical diseases may be thence predicted.

If now, what has been said at § 322. concerning the idea of contusion, with the inseparable effects of every contusion, enumerated at § 323, are applied to the several different parts of the body, which are capable of being injured by contusion, it will immediately appear what bad consequences are thence to be feared; which may be then safely predicted, from the
known

known fabrick and uses of the parts: as for example, if any one should fall and strike the right hypochondrium against a hard obstacle, and soon after a considerable yellowness appears in the eyes and skin; it will be thence evident, that the bile being pressed back, has infected the mass of blood, and that therefore the region of the gall-bladder, and liver itself, have been injured by the contusion. If again it be considered, that the substance of the liver is so very tender, that it resembles a sponge full of blood, there is great danger lest a large quantity of blood should be extravasated from the ruptured vessels, within the cavity of the abdomen; whence convulsions, faintings, and death itself, may often ensue, in a short space of time. But if the injury is slight, and only the smaller vessels are ruptured, within the substance of the liver; even then the extravasated humours may compress the adjacent vessels, or else corrode them by putrefying, so as to produce an inflammation, suppuration, scirrhus, *etc.* in this viscus; whence death slowly follows, after the patient has endured the greatest miseries. If the region of the loins should be injured by a violent contusion, and bloody urine follows, we know then that the small vessels of the kidneys are ruptured; whence again may follow the very worst accidents: for the grumes of congealed blood escaping into the narrow passages of the pelvis and ureter, may wholly intercept the course of the urine from the kidney to the bladder; whence an inflammation of the kidney, suppression of urine, *etc.* may follow. Even a small particle of congealed blood, left in these passages, may form the basis of a calculus, to which the earthy particles will on all sides adhere; whence a train of new maladies again follow. If now it be considered that the like injury may happen in the other viscera, it will be very evident that innumerable disorders may thence follow, which will either kill the patient in a little time, by extravasating the juices, and destroying the fabrick of the parts, whose

whose continuity is absolutely necessary to life, or otherwise, the patient may survive under the burden of diseases, from the injured functions of the parts, whence many chronical and often incurable disorders follow. This is demonstrated by an unlucky accident in a bold commander, who rushing against the enemy upon a fierce horse, that received a wound, the horse suddenly raised himself, by which means the pommel of the saddle was very violently pressed against the region of his stomach. A vomiting of much blood immediately followed; and as the noble person could not observe a proper regimen of life, and as he drank much wine, quite neglecting so great an accident, though he survived a considerable time, he was troubled with excruciating pains in his stomach, during life, till at length a very troublesome vomiting, dysentery, &c. put a period to his miseries by death; and on opening the body, a large part of the liver, and the whole pancreas, were found cancerous. Thus also the worst maladies may follow from a contusion of the testicles. I saw a scirrhus testicle from this cause, which being imprudently treated with emollient and suppurating medicines, grew to such an uncommon bulk, that the scrotum with its included testicle nearly extended to the knee of the same side; and which was afterwards eroded by a frightful cancer, that occasioned death, after the worst calamities, in a person who was otherwise very healthy.

S E C T. CCCXXIX.

A Present contusion, with the part it affects, is known, 1. by inspection, and by the touch; 2. by its effect, pain, numbness, heaviness, a change of the colour to red, brown, livid or like lead, black, yellow, or green, a hæmorrhage, gangrene, &c. (323 to 327); 3. by comparing

paring the shape and violence of the contusing instrument, with the nature of the part injured.

This aphorism treats of those signs by which a contusion is known to be present, and by which the part affected is discovered.

1. For the vessels being ruptured under the entire skin, their extravasated juices fill and distend the panniculus adiposus; whence a tumour and softness of the contused parts appear to the eye and touch; and this more especially in contusions of the head, because the hard skull occasions the extravasated juices to make the greater distention of the integuments outwards: which is elegantly expressed by Terence^a, where a procurer being heavily fined for his deserts by a youth, says:

*Omnes dentes labefecit mihi!
Præterea colaphis tuber est totum caput.*

2. Pain attends almost in every contusion; but when the contusion, being very violent, has destroyed almost all the vessels, there is then only a very obtuse or no pain; but in such a case there is a numbness, and a dull sensation in the affected part, which denotes that the sensible nerves are destroyed in the contused places, or are else so compressed by the extravasated humours, and the contusing instrument, that they remain no longer sensible. But as the extravasated blood is generally collected under the entire skin, the colour of the contused part will be altered, according to the different quantity of extravasated blood, and also according to the different time that is pass'd since the contusion was inflicted. For a slight contusion is followed with a red colour, there being but little blood extravasated, from a rupture only of the smaller vessels; but yet that redness be-

^a Adelph. Act. II. Scen. II. versu 36.

comes more obscure after a few hours, and inclines to black. But after a violent contusion, the colour of the part affected is often instantly changed to a leaden, livid, and frequently a black, from the large quantity of blood lodged under the entire skin; and although the colour was red at first, yet, by the exhalation or absorption which is afterwards made, of the thinner parts of the blood, the remainder turns black. But this leaden or livid colour of the contused part, ought not to give us any great surprize; for it is not always the mark of a gangrene, which may be easily distinguished by the coldness and elevation of the cuticle into vesicles, full of ichor, appearing in the morbid part. When the concreted blood begins to dissolve and be dispersed, then the leaden or black colour becomes gradually fainter, and begins to incline to red; and a yellow or greenish colour appears in the margin of the contused part, from the gradual dissolution and dissipation of the red part of the blood; which green or yellowish coloured margin is therefore a sign that the extravasated and concreted juices begin to be dissolved. It is well known, that when blood is drawn from the vein of a healthy person, it soon afterwards separates into two parts; the one a limpid serum, and the other a red concrete floating in the serum. If now all the serum is poured off, there will appear a considerable quantity more in a few hours time, as the red concrete gradually dissolves; so that by frequently pouring off the serum, almost the whole red part will at length vanish. The same dissolution seems to happen in these contusions, where the concreted blood is by degrees resolved into a thinner serum; from whence follows that change of colour in the contused part, when the extravasated blood begins to be attenuated and dispersed. This circumstance has been well observed by Hippocrates^b, where he treats of a fracture in the calcaneum; for he reckons it one of the best signs, denoting that there

^b De Fracturis Textu 30 & 31. Charter. Tom. XII. page 205.

is no danger. *Si suffusiones (ἐκχυμώματα) & nigredines, & circumambientia loca subviridescant, sine duritie. Optimum illud testimonium in omni suffusione, &c.* “ If in
 “ contusions the circumjacent parts look greenish,
 “ without hardness and black spots. And that this,
 “ sign is of the best import in every contusion,” &c.

Unless a considerable wound is made in the skin, there seldom happens any profuse hæmorrhage in a contusion; for the blood extravasated from the ruptured vessels, being collected in the panniculus adiposus, congeals and stops up the course of the blood, which is about to escape. But if the viscera or larger vessels are much injured by contusion, a large quantity of blood may be extravasated within the cavities of the body: as when, for example, the liver shall be thus injured; but then paleness, coldness of the extremities, great weakness, fainting, &c. sufficiently denote such an internal hæmorrhage. But when all the vessels in any part of the body, are so destroyed by a violent contusion, as to abolish all the vital influx and reflux of the juices, into and from the part, a gangrene or death of that part is then present.

3. We know a contusion is present, when we are informed that some hard and obtuse body in motion has struck upon the part, or that some part of the human body in motion has been forced against some such hard obstacle. Hence a wound is frequently accompanied with contusions, unless the wounding instrument was sharp. At the same time too the nature and situation of the part injured must be also considered, as for example, that the viscera of the thorax are less exposed to injury by contusions, and that the viscera of the abdomen are more easily exposed to the same injury.

S E C T. CCCXXX.

AND it is hence well known; 1. that an internal and large contusion, in one of the more noble viscera, is incurable; and must therefore occasion several diseases, and death itself. 2. That a contusion in the bones is very dangerous, and difficult to cure; especially when near their articulations or medulla. 3. That a contusion of the skull is worst of all, as we before demonstrated, from the vicinity of the brain. 4. That contusions of the larger glands seated at the ears, arm-pits, breasts, or the groins, uterus, pancreas, &c. threaten a scirrhus, cancer, and the disorders that may thence follow.

What prognosis ought to be formed, from a knowledge of the part injured by contusion, is made evident in this aphorism.

1. For the vessels being ruptured, will either produce a fatal hæmorrhage, uncapable of being suppressed; or else the contused parts must be separated by suppuration from the sound, as Hippocrates observes, in the place cited from him in the commentary on § 323; but from internal suppurations a consumption very frequently follows, which slowly destroys the unhappy patient. Besides this, since all the viscera have a share in constituting the health of the patient, therefore the function of the diseased viscus will be so much depraved after the suppuration, that if the patient survive, it will be in a miserable and diseased state. Now as these injuries by contusion happen more frequently in the liver and spleen, from the exceeding tenderness or friability of those viscera, it is very evident, that the worst consequences may be there expected, and that the cure will be extremely

difficult, the patient being very rarely restored to a perfect state of health, because more or less of a scirrhus almost constantly remains during life, which will disturb the functions of the injured viscera.

2. For a rupture of the vessels, which afford life and nourishment to the lamellæ of the bone, will occasion them to mortify and separate; but if such a contusion is made near the articulations in the larger bones, there is scarce any room to hope for a separation or exfoliation of the dead parts: because in those places the lamellæ of the bones recede from each other, and form cells, in which the blood-vessels are distributed in great numbers, together with those vessels which contain the thin oil, which juices will be therefore corrupted by stagnating, and acquire a putrid acrimony, sufficient to destroy the parts, whence a caries of the bone, and all the maladies that may thence follow. But if the medulla itself is injured, the very worst or rancid acrimony thence follows, sufficient to corrode the whole substance of the incumbent bone. See what has been said in the commentary on § 325. To which add, that the bones cannot be confused near their articulations, without injuring the ligaments at the same time, which articulate the bones, whence excruciating pains, anchyloses, &c. may follow.

3. Of this we treated before, in the history of wounds in the head.

4. Consult what has been said in the commentary on § 324. In all the places here enumerated, there are very considerable glands seated, from a contusion in which the very worst maladies may follow. Among ten cases where the breasts are scirrhus or cancerous, nine of them are probably from contusion. Agreeable to this, I saw an unhappy woman, whose child lying with her, with its whole weight upon her breast, made a contusion with its elbow, by endeavouring to turn itself, whence a scirrhus followed throughout the whole breast, which was considerably tumified,

Ligaments
See remark
Page 31, I. I.

tumified, and in a few weeks time degenerated into a frightful cancer. The like injuries have been frequently observed in the parotid axillary and inguinal glands, arising from contusion. But the uterus, in women who are not with child, is sufficiently well secured on all sides, by the bones of the pelvis; so that it cannot be easily contused, as it may in those who are far gone with child, when the bottom of the uterus rises up above the ossa pubis: but the uterus may be also injured by the imprudent handling of the midwife, or by the difficulty of the birth; from whence a scirrhus of the uterus, degenerating into a cancerous ulcer, has been very frequently observed.

S E C T. CCCXXXI.

IN the cure of a contusion it must be always endeavoured to procure a discussion, to prevent a suppuration, and more especially a gangrene.

Since the solid parts of the body are broken in pieces by contusion, and the extravasated juices are let into foreign parts; it is therefore required in order to a cure, to discharge the extravasated juices, and to unite the solid parts which are divided. This will be most happily procured, if the concreted juices are rendered fluid; for then they may be absorbed by the bibulous vessels, and returned into the common course of the circulation. This method of cure is said to be by resolution or dispersion. But a suppuration must be here avoided, if possible; because by that means much of the substance of the contused part is destroyed, by a separation of all that does not admit the circulating juices, from whence unsightly scars frequently remain; and the cellular membrane being consumed after a violent suppuration, often oc-

casions the muscles and tendons to adhere to the adjacent parts, whence their action is either depraved or abolished. But it is certain, that a suppuration cannot always be prevented; though it is also equally certain, that some contusions may be frequently removed or dispersed, by the application of those remedies mentioned in § 333, 334, by the neglecting or the too late using of which, it would certainly tend to suppuration. But it is very evident, that a gangrene ought to be still more industriously avoided, as that wholly destroys the vital influx and efflux of the juices to and from the part affected; which being afterwards mortified, must be then separated by suppuration, from the adjacent living parts.

S E C T. CCCXXXII.

A Resolution or discussion is procured by removing the extravasated juices, without any farther injury to the vessels.

It is a general indication in all contusions, to remove the extravasated juices; but if, for example, a division of the contused part by incision, will give a vent to the extravasated blood, this cannot be termed resolution, because the parts suffer a new injury. The same is also true, when the cure is performed by suppuration; for then the extremities of the injured vessels are separated, and discharged with the extravasated juices, in the form of pus. But in order to a resolution, it is required that no farther injury be offered to the parts, while the extravasated juices are in the mean time carried off: and this is what Hippocrates^a terms the drying up, or absorption of extravasated blood: for in treating of those disorders which follow a contusion of the flesh about the ribs, without a fracture of them, after describing the pro-

^a De Articulis textu 66. Charter Tom. XII. pag. 397.

per remedies, he adds, that a suitable bandage is necessary, *ἕως ἀν ξηρανθῆ μεν, ἢ ἀναποθῆ τῆτο τὸ ἐκχύμωμα, τὸ ἐν τῇ θλάσει γενόμενον*: “But as for the blood which is “extravasated in the contusion, let it be dried up “and absorbed.” But in what manner, and by what means, this resolution may be obtained, is declared in the following aphorism.

S E C T. CCCXXXIII.

BUT this resolution is procured, 1. by rendering the juices fluid; 2. by relaxing the adjacent vessels; and 3. by directing the juices into the vessels, by evacuating them, and by frictions.

1. The blood extravasated from the vessels, immediately concretes, and by that means is rendered unfit both for passing through the smaller blood-vessels, and for being absorbed by the mouths of the veins. The first thing therefore required, is, to render the concremented juices fluid. For if the extravasated juices can be reduced to the tenuity of water, they will certainly be dispersed, provided the body is healthy in other respects. Hippocrates^a pronounces, *Carnes attractrices ex cavo, & extrinsecus*: “That the flesh attracts “or absorbs, both from within and without.” And he also acknowledges the whole body to be perspirable, or exspirable and inspirable. The extravasated juices will be therefore absorbed by the bibulous veins, which open in all the larger and smaller cavities of the body, provided it be sufficiently attenuated to enter them.

2. All the attenuated juices which are to be absorbed, must enter the exceeding small bibulous veins, and be conveyed by them to the larger branches. Now it appears from incontestible experiments, that

^a Lib. 6. Epidem. in initio. Charter. Tom. IX. pag. 540.

any of the smallest tubes, made of the purest glass, by drawing out at a lamp, upon having one end immersed in any liquor, will attract the liquor into their cavity; and that the liquor will ascend higher into the tube, as it is of a smaller bore, and more inclined from the perpendicular, towards the horizon; but the most of all when one end of it is inclined lower than the other, for then the attractive force, by which the liquor is drawn into the tubes, is assisted by gravity. The like action seems to obtain, when the extravasated humours being first attenuated, enter the exceedingly minute tubuli of the absorbing veins. But the valves which are conspicuous in the smallest lymphatic veins, prevent their contained humours from resisting the ingress of the absorbing juices. Now flexible canals are the more easily filled, in proportion as their sides give a less resistance; and therefore relaxation of the adjacent vessels facilitates the course of the absorbed juices, through the exceedingly minute ducts, into the larger venal branches, which is here required.

3. The juices thus absorbed by the minute venal ducts, will go on more easily through the large venal branches, as they contain less humours to be moved; provided the powers, which promote the motion of the venal blood, remain the same; *viz.* principally the pulsation of the arteries, contiguous to the veins, with the motion of the muscles; for the muscles swelling in their action, compress the adjacent veins, and drive the blood through them towards the heart. If therefore the mass of humours to be moved is diminished, and the moving powers remain equally strong, it is evident that the veins will be more speedily evacuated, by which means the juices to be absorbed by the minute bibulous ducts, will have a more easy entrance. This doctrine is also confirmed by experiments; for when men travel in the scorching sun, having their bodies rough, and their mouths parched up with excruciating and burning thirst, they
have

have been surprized to find their thirst extinguished, and their mouths moistened, after bathing, which has rendered the whole body so moist and soft, that none of the former roughness appeared. This is an experiment produced by Galen ^b, to prove, that the whole body is inspirable. For by violent exercise in a very hot air, many of the thin juices are exhale from the body, by which means becoming very dry and bibulous, it eagerly absorbs the water contiguous to its external surface. Perhaps it may be from hence that the body is filled with watery humours, after great losses of blood, when the small absorbing veins very easily discharge the absorbed humours into the larger empty veins: but in the mean time, the strength being weakened, and the heat of the body diminished, occasions the thin watery juices to be accumulated in the larger and smaller cavities of the body, which are said by Hippocrates to contain spirits in a healthy state, and ichor in a disordered state, as we observed in the passage before cited in the commentary on § 323. And perhaps from thence may be deduced the reason why dropical patients so soon swell again, after all the water has been discharged by paracentesis, or any other way, even though they abstained from drink: for notwithstanding a very large quantity of water is collected in the cavities of the body of the dropical patient, yet the rest of the vessels collapse, and are evacuated, whence the rest of the body consumes in proportion as the abdomen is distended in an ascites, whence the body becomes more bibulous.

But frictions, with a gentle compression, act more upon the veins than upon the arteries; because the coats of the veins are thinner, whence the veins will be emptied; and as there is an alternate compressure and relaxation of the parts, in all frictions the veins will by that means be first emptied, and then directly

Vein
they are
also much
more fee-
ble than the
arteries

^b Commentar. in Lib. 6. Epidem. Hippocr. Charter. ibid. pag. 541.

Consequent:
by more af-
filled
friction, than the arteries which
by deeper. I. I.
The Capillary Arteries are equal
to superficial veins & the Veins.
(Arteries)

filled again; so that frictions will produce much the same effect with evacuations; namely, by emptying the vessels, they will facilitate the ingress of the juices, to be absorbed through the small mouths of the bibulous veins. Add to this, that the extravasated and concreted blood itself, will also be attenuated and resolved by the friction: for if the blood which has been taken from the vein of a healthy person, and congealed in the open air, be ground in a glass mortar, it will be again dissolved into a frothy and red coloured liquor; and therefore frictions are evidently of the greatest use in the cure of convulsions.

S E C T. CCCXXXIV.

Therefore plentiful blood-letting, with the exhibition of a cooling purge, that acts briskly without inflaming; the application of discutient, relaxing, and penetrating fomentations to the part itself, with warm frictions, and the internal use of attenuating, sudorific, and diuretic medicines, will be here serviceable.

In this aphorism are enumerated the most efficacious remedies, for answering the curative indications proposed in the aphorism preceding.

Plentiful blood-letting.] For this is one of the chief remedies in all contusions, provided the patient is strong; and therefore it ought to be boldly used, and repeated as may be found necessary. Thus an intense fever and inflammation, which are the most to be feared in these disorders, may be prevented; because the grossest parts of the juices, namely, those of the red blood, are thus evacuated from the vessels, and an easy passage given to the thinner juices taken into the body. At the same time also, the depletion of the larger veins by phlebotomy, will facilitate the
absorp-

absorption, and the transmission of the juices imbibed by the smallest veins, towards the larger branches, whence the extravasated blood will be more readily dispersed.

With the exhibition of a brisk purge soon after, that will not inflame.] Those medicines which are called purgatives, do not only evacuate those humours, which before existed under the same form within the body, as they appear in at their discharge; but they also dissolve the healthy juices, and evacuate them from the bowels when dissolved, as was proved in the commentary on § 201. And from hence Erasistratus and his followers rightly concluded, *Purgationes esse evacuationes una cum corruptione & immutatione illorum, quæ evacuantur*: “That purging is an
“evacuation made with a corruption and alteration
“of the humours evacuated.” Galen^a indeed espouses the contrary opinion; but this seems to be truly the case. For scammony being given to the most healthy person, so dissolves the sound juices, that being melted into a thin water, they are discharged by stool in an incredible quantity; and if the use of the same medicine be frequently repeated, the whole body will be emaciated, the vessels will collapse, and extream weakness will follow. All which sufficiently evince that the juices were not evacuated, as existing before in a morbid state, but that the sound humours are expelled from the body, after they have been dissolved into a thin and foetid water, by the force of the medicine. By these remedies therefore the vessels are emptied, and the humours dissolved, while at the same time the small veins are rendered extremely tubulous; as they open throughout the whole external and internal surface of the body, which is evident from a remarkable experiment. A young man having a fever, attended with a diarrhoea and a great stupidity of his senses, would not take any thing by

^a Galen. de purgant. Medicam. facult. cap. 2. Charter. Tom. X. pag. 464.

the mouth; though the fever in the mean time continued to dry up the body by its heat: hereupon the physicians ordered his feet to be immersed in warm water; which being done, a surprising consumption of the water in the vessel was speedily observed, and soon after followed an impetuous discharge of the same water, almost uncoloured, by the anus^b. Hence it is evident, that these purges very well satisfy the indications of the first and second number of the preceding aphorism: for the humours are thus dissolved, the vessels evacuated, and that power increased, by which the juices are absorbed by the bibulous veins.

But it must be at the same time remarked, that those strong purges are not useful in this case, which act by exciting violent motion, such as the colocynthis, euphorbium, &c. but such only are here useful, as having a power to dissolve the juices, do notwithstanding produce their effects without much disturbance; as scammony, jalap, leaves of senna, &c. of which various forms are prepared in the *Materia Medica Boerhaaviana*.

Penetrating fomentations, &c.] As the extravasated blood lies generally congealed, under the entire skin of the contused part; it ought therefore to be rendered fluid in such a manner, as to prevent it from putrefying at the same time. Now congealed blood gradually dissolves, barely by exposing it to the open air, but then it also putrefies; and therefore it is necessary for these fomentations to have a power of resisting putrefaction, as well as of attenuating and dissolving. Such a fomentation may be made of sal ammoniacum, or sea-salt, dissolved in twenty times as much water, with the addition of a fourth part of wine, and an eighth part of vinegar, which being applied warm, will answer all these intentions. For the water in it relaxes, while the salt, wine and vinegar, prove good dissolvents, and at the same time prevent

^b De Re Medica dissertat. quatuor Thomæ Simsoni, pag. 183.

any putrefaction. The urine of a healthy person, mixt with a small quantity of vinegar, composes a fomentation of the like nature; with which those tumours of the head are happily dissolved, which so frequently result from contusion in children.

Several medicinal simples may be also infused in the water, for this purpose, in which there is a power of dissolving; and the form of such a fomentation may be seen in the *Materia Medica* of our professor. Various emplaisters are also adapted to this intention, which may be seen enumerated in the *Materia Medica* corresponding to this aphorism. These last, while they adhere to the skin by their tenacity, restrain the most subtle juices from exhaling, and repel them in a manner to the part upon which they are applied; so that the part affected continues as it were in a bath of its own vapours, which relaxes the vessels; and then the aromatic or fragrant particles of the emplaister insinuating themselves into the relaxed vessels, frequently produce the desired effect, when fomentations are not so serviceable, unless they are continually retained warm upon the affected parts.

Warm frictions upon the part.] If no inflammation nor any great pain appears in the contused part, gentle frictions are extremely useful. For by this gentle agitation, the concremented blood is attenuated and divided, so as to be capable of returning through the small mouths of the bibulous veins. At the same time also the veins are thus emptied, so as to facilitate the motion of the absorbed humours through the depleted vessels, as we said before in the commentary to the preceding aphorism. Thus a man being abused by his enemies, had his whole face frightfully tumified by contusion, which was happily dispersed by these fomentations, joined with continual and gentle frictions, insomuch that no manner of suppuration followed in the tumour, and his face recovered its former shape, which could be hardly expected.

Internal attenuating medicines, &c.] Those medicines which restore the concreted parts of a fluid, to the same state of fluidity which they possessed before concretion, are termed attenuants or resolvents. Among these, warm water has the chief place; partly inasmuch as it dilutes, by insinuating itself betwixt the concreted particles; and partly, because it is the vehicle that dissolves all other medicines, concerning which you may consult what has been said before in the commentary on § 54. numb. 4. Phlebotomy therefore being premised, with the use of those antiphlogistics or cooling purges, which powerfully dissolve the humours, without putting them into any violent commotion; it will be next most convenient to give a large quantity of some decoction which contains much water, replenished with such particles, as may by a gentle stimulus excite the vessels, to act a little more powerfully upon their contained juices; and also, that the unactive water may not be retained or accumulated within the body, observing likewise to chuse such ingredients as resist putrefaction. Hence it is that the infusion of scordium, rue, horehound, &c. with the five opening roots, the three sorts of Sanders, nitre, honey, &c. are so very serviceable in these cases. For when the vessels, being first depleted by phlebotomy and the use of purges, are continually filled by drinking these decoctions warm, while at the same time the contused parts are continually treated with fomentations and gentle frictions, so as to derive the action of the internal medicines to the injured part, (for which see the commentary on § 134.) every thing is then done that can be expected from art. For then warm water, replenished with the dissolving virtues of the preceding remedies, will every moment be conveyed to the extravasated humours, which will be thus diluted, dissolved, and rendered fit to return into the smallest veins; so that all the extravasated juices are thus carried off, without further injury, which is required by the intention.

But

But since all these remedies, taken in large quantities, are usually again discharged from the body, either by a diaphoresis, or by the urinary passages; therefore such a discharge is to be performed, by a sudorific regimen: as when a person is on all sides encompassed with a warm atmosphere, by lying in a bed, well covered, which will excite a sweat; but if the patient remains in a cold air, that generally occasions a more copious discharge by urine.

S E C T. CCCXXXV.

THE order of which remedies, with the necessity of repeating them, and in suitable doses, is determined by (334), with the dangerousness of the case.

There is no necessity to use all these assistances of art, in every contusion; for slight accidents of this kind may be removed barely by the use of fomentations, composed of urine, salt, vinegar, and the like: but when there is danger of a violent inflammation with a stoppage of the circulation, and a gangrene; then all the forementioned remedies are to be brought into use. In that case therefore we are to begin with phlebotomy, using it liberally, if the patient's strength will permit; and in the next place to give the forementioned purgatives, that by dissolving the humours, and weakning the vital powers, the body may be far from being inclined to inflammation or fever. If the tumour, pain, and inflammation do not yet diminish, by the use of these means, they are to be boldly repeated, especially when the contusion has injured some internal part; for then the worst consequences may be feared, from a suppuration, or else an incurable scirrhus may remain, from the imperfect cure of the disorder, which may terminate in a cancer, and produce the most grievous symptoms.

toms. But when the symptoms diminish by the use of these means, then, if the affected part is accessible to the hand, gentle frictions will be extremely useful; and not before: for the tense and inflamed parts, distended by the extravasated humour, may by a rough friction be rather excited to a speedy gangrene.

S E C T. CCCXXXVI.

AT the same time also a very thin diet, of aliments the least apt to putrefy, is here required.

For the intention requires to dilute plentifully all the juices, and to support life in such a weak state, that there may be no danger of inflammation; and as the extravasated humours are spontaneously inclined to putrefaction, therefore a diet of such aliments is to be chose, as will resist that kind of alteration in the juices. Hence a decoction of barley, oats, rice bread, and the like, in milk and water, with boiled apples, and other ripe garden fruits, are here highly recommended; also weak flesh broths boiled with rice or barley, and mixed with a little citron juice, are likewise equally serviceable. Nor is there any danger that this weak aliment will not be sufficient to support life; for the human body at rest, may be supported even by the poorest nourishment. This is what the celebrated Boerhaave has experienced in himself, when being tormented by the most severe pains in a rheumatism, he lived for the space of twelve days only upon whey; and yet he continued in good strength, sufficient for exercising the muscles, if the pain had not opposed. But the body being weakened by bleeding, and the use of purges, cannot act so powerfully upon the ingested aliments, to change them into its own nature; whence the aliments will be
more

more easily inclined to degenerate spontaneously according to their own nature. But as a putrefaction is to be feared in the extravasated juices, therefore such aliments are principally recommended in the diet, as have naturally a greater inclination to acidity; and for the same reason likewise, flesh, eggs, fish, and the like, are to be avoided. But all acrid sauces, spices, and the like, are pernicious, by increasing the motion of the circulation, which ought in this case to be rather weaker and more sedate. But in all these cases a regard must be likewise had to the season of the year, with the healthy or morbid constitution, and custom or course of life in the patient, &c. concerning all which you may consult what has been said in the commentaries on § 192 to 196.

If all that has been said concerning the diet and remedies afforded by pharmacy and surgery be duly observed, they will be always attended with success when the disorder is curable; but all other boasted specifics for contusions ought not to be trusted to alone for the cure of the disorder, though many of them are innocent, and may be used, provided the forementioned very efficacious means are not neglected. Thus Helmont^a recommends the dried blood of a goat, that follows after cutting off his testicles, which he would also have to be given to such as fall from high places, in order to disperse the concremented blood in the contusion. Others recommend spermaceti, a decoction of madder, &c.

S E C T. CCCXXXVII.

BUT if the contusion is so large that it cannot be resolved, and is at the same time accessible to the hands, a scarification, incision, or supuration must take place, observing what has been said in (334.) Or else, if the contusion is

^a Ortus Medic. in Capit. Pleura furens, pag. 322. n^o. 32.

fo great as totally to deftroy the life of the part, or is fo conditioned, that one may thence certainly forefee, that intolerable pains, inflammations, a fuppuration, confumption, fever, or death itfelf will follow, an amputation ought then to be timely made, when that is practicable, (464 to 475).

When the injury is fo great that one can by no means hope to difperfe the extravafated juices, without further damage to the veffels, the only remedy that then remains, when the contufed part is accessible to the hand, is to make an opening for the difcharge of the extravafated juices, and then to deterge the parts by a mild fuppuration, fo as to reduce them to the ftate of a clean wound. For if this method is not taken, the extravafated juices compreffing the adjacent veffels, may occafion an inflammation, or by wholly fuppreffing the vital circulation in the part, a gangrene may follow, which, if attended with a putrefaction, may occafion ftill worfe confequences. In this cafe then the contufed part is to be entirely divided, or elfe punctured in many places, by fcarifying with a lancet, to give a free difcharge to the extravafated humours; and then the fubjacent living parts, being fet at liberty from the compreffure, will expel and caft off all that has been fo injured by the contufion, as to be no longer obedient to the laws of the circulation. But this ought more efpecially to be performed, when very dangerous confequences are to be feared from an inflammation or erosion of the adjacent parts, as was obferved before in the hiftory of wounds in the head in § 243, 244, 248.

But notwithstanding the difference of the cafe, the remedies mentioned in § 334. ought not to be here neglected; for if the inflammation proves too violent in the contufed part, it may produce a gangrene inftead of a laudable fuppuration. Therefore phlebotomy and cooling purges are here highly ufe-
ful,

ful, joined with those fomentations which restrain putrefaction: and at the same time it will be always useful to give large quantities of the attenuating decoctions, that all such parts of the corrupted juices or purulent matter, which have infected the mass of blood by returning through the bibulous veins, may be discharged from the body, either by a diaphoresis or the urinary passages. As it appears from what has been said before, that the extravasated blood may be so attenuated, as to be absorbed by the bibulous veins; so also may the matter or corrupted ichor return the same way, and infect the blood, so as to produce a very bad state of the juices; from whence again various bad consequences may follow.

But when a violent contusion has so injured the larger vessels, or has so far destroyed the fabrick of the part, that the vital circulation of the juices through the part is no longer continued, a perfect blackness or mortification thereof follows, which destroys them all. In that case there is but one remedy remaining; namely, to extirpate the part to preserve the life of the patient. That this is the state of the disorder, may be known, if no warmth nor any sensation remains in the contused part, even though it be deeply scarified; and a putrefaction speedily following affords a cadaverous smell. If now the part thus affected be not speedily extirpated, by the spreading of the sphacelus, the patient will be soon destroyed. Such a case happened to an expert coachman, who in breaking some unruly horses fell off of the chariot by their running away, whence his legs being unhappily twisted in the wheels were crushed to pieces in such a manner, that neither sense nor warmth any longer remained in the parts; but as this man would not admit them to be amputated, which was here absolutely necessary, he therefore expired on the fourth day after. The same is also true, if the bones are so fractured by a violent contusion, that they separate into small fragments or splinters, which, by pricking and

irritating the nervous parts, may produce the most severe pains, violent inflammations, and the bad consequences which may thence follow. A man had his right hand so violently contused by the falling of a cask of wine, that the bones of the metacarpus, which sustain the index, middle, and ring finger, were crushed to pieces, together with the adjacent muscles and vessel. The celebrated surgeon employed affirmed, that there was no remedy remaining but an extirpation of the contused parts; and that if the operation was neglected, a train of the worst symptoms would soon follow. But yet the wounded patient was unwilling to suffer the operation, and notwithstanding the best remedies were applied for the space of two or three days, the pains were very severe, the inflammation so violent, and the tumour so large, that it evidently appeared a gangrene would soon follow; but the contused parts being then immediately amputated, the patient was happily cured^a. But how much may be effected, even in the most desperate cases, by an intrepid courage in the patient, with great skill and dexterity in the surgeon, may appear in the following history taken from the forementioned author^b. A captain of a ship of war had his whole arm, by an unlucky accident, so miserably contused, even up to the shoulder, that neither sense nor warmth remained throughout the whole limb; and although a true sphacelus had already spread itself beyond the shoulder, and the whole arm corrupted with a cadaverous stench, the surgeon confiding in his art, and the patient full of courage, preferred a doubtful remedy before certain death; whence the limb was immediately amputated in the articulation, and nature, being afterwards assisted with proper remedies, separated the rest, which was already corrupted; so that in two months time he returned safe to his friends, snatch'd in a manner from the jaws of death.

^a De la Motte Traité complet de Chirurgie, Tom. III. pag. 247.

^b Ibid. pag. 408.

S E C T. CCCXXXVIII.

BUT more may be performed by the preceding method (331 to 336) than any one would imagine; because nature herself is always ready to assist towards a spontaneous separation, attenuation, resolution, dispersion, and expulsion in the parts injured.

But yet recourse ought not to be had immediately to amputation, since the most faithful observations teach us, that such disorders have been sometimes happily cured, though they have seemed altogether desperate. Therefore it seems to be most adviseable always to make trial first of the methods proposed in the aphorisms here cited, whenever that may be safely done; and in the mean time we are furnished with several remedies, by which the parts, even though mortified, may be so preserved, that the putrefaction will not easily spread; such as *alliaria*, *scordium*, *marrubium*, *salvia*, *ruta*, &c. which being infused in water, with the addition of salt, urine, and vinegar or spirit of wine, form a fomentation, which being applied warm both by day and night, certainly restrains all putrefaction; so that one may safely wait a few days to see whether nature will attempt a separation, or whether any signs appear of life returning again into the part. Thus our celebrated professor is used to tell his audience, that a German nobleman belonging to this university was flung out of a chaise, and the wheels running over his legs, miserably fractured the tibia and fibula of each leg, with a frightful laceration of the adjacent parts, which, though invaded by an incipient gangrene, were cured by the use of these remedies. There is also a surprising instance related in the observations of the celebrated Le Motté ^a, of a young

^a De la Motte Traité complet de Chirurgie, Tom. III. pag. 405.

man who received such a violent blow upon the anterior part of his right arm, that a violent contusion appeared to extend itself from the cubitus to the carpus, attended with extreme pain: the patient had applied linen cloths dipt in spirit of wine, but perceiving scarce any relief from thence, was obliged to have recourse to a surgeon. The pain had now almost vanished in the hand, but was more violent in the cubitus; the affected hand appearing pale and quite cold, and the skin being roughly handled, came off from the ends of the fingers. No pain was perceived in the hand, even by deep scarifications made with a lancet; nor did so much as a drop of blood follow, after thrusting a lancet quite through the hand; and this coldness and insensibility extended to the middle of the cubitus. The parts were fomented with spirit of wine mixed with salt and unguent. *Ægypt.* and at the same time a cataplasm was applied composed of barley-meal, with the flower of beans and lupins, mixed with spices and wine; by the use of which remedies the warmth and sensation returned down to the carpus, the whole hand as yet remaining cold and senseless; and though it had continued thus for the space of five days, was neither foetid nor black coloured. Scarifications being again made in the hand, warm oil of turpentine was afterwards applied, and then the other remedies as before for the space of five days more without any alteration in the parts; but from that time the warmth and life began to return, and the patient was happily cured without any amputation, only two of the fingers remained afterwards contracted, with a stiffness in the rest. Since therefore the contused part could be thus preserved in so desperate a case, it seems to be the duty of a prudent surgeon or physician not to have recourse to amputation, unless all other means have been tried without success. For if the force of the blood may be so abated by phlebotomy and the use of other remedies, that there is no danger of an inflammation or gan-
grene

grene from the contusion, and at the same time such applications are used externally, as restrain putrefaction, joined with a thin diet, not at all inclined to putrefaction, there is great room to hope that the corrupted parts will be separated from the living, and that the lost substance will be afterwards regenerated.

Of FRACTURES.

S E C T. CCCXXXIX.

IF the parts of a bone are violently separated from their cohesion into large fragments, it is called a fracture.

Hitherto, we have been treating of a solution of continuity in the soft parts of the body, and we come now to consider the same disorder in the bones. But a solution of continuity in a bone is by the Latins distinguished by the name of *fractura*, called by the Greeks ^a *κάταγμα*; though a solution of continuity made in the cartilages has never obtained a distinct name, but is comprehended under the title of fracture; at least Hippocrates ^b uses this name in treating of fractures in the joints, which are wholly cartilaginous, where he says, *ἢν ᾗ ἔς καταγῆ, ἔσ.*

But it is customary not to term every solution of continuity in a bone a fracture, but only that which is made by some external violence, as Ægineta ^c observes, where he says, *In universum autem fractura est divulsio ossis, vel ruptura, vel discissio à quadam vi externa facta*; “But in general a fracture is either a
“divulsion, rupture, or cutting asunder the parts of
“a bone made by some external violence.” For

^a Galen. Meth. Med. Lib. VI. cap. 5. Charter. Tom. X. pag. 143.

^b Hippoc. de Articulis, Text. 48. Charter. Tom. XII. pag. 361.

^c Lib. VI. cap. 89. pag. 96. versa.

thus a fracture is distinguished from a caries of the bone. It is also added in this definition, that it is called a fracture when one part of a bone is separated from its cohesion with the other, in order to distinguish it from a luxation, in which the naturally contiguous bones are removed from each other. But then to distinguish a fracture from a contusion, which supposes a crushing of the solid parts (*vide* § 322.) it is added in the definition, that the disorder is called a fracture, when the parts of a bone are separated into *large fragments*. But notwithstanding this, the ancients refer a comminution of a bone into very small fragments, to the head of fractures, provided it arose from some external violence; and such a species of fracture they called *ἀλφειδον* ^d.

S E C T. CCCXL.

WHICH division of the bone being single, and by itself, denominates the fracture *simple*; but when there are several divisions of the bone, it is a *compound* fracture; or if accompanied with a wound, contusion, inflammation, an ulcer, or many fragments, it is then called a *complicated* fracture.

Surgeons usually distinguish fractures into three species, *viz.* simple, compound, and complicated. A simple fracture is said to be, when a single bone is only fractured in one place, without any considerable injury of the incumbent parts adjacent. But when such a fracture happens in any part of the body, where two large bones lie by the side of each other; as for example, in the cubitus; if the radius only is fractured, without injuring the ulna, that species of fracture is then termed incomplete, by some surgeons; because the situation of the parts is not then much

^d Lib. VI. cap. 89. pag. 66. versa.

disturbed,

disturbed, and the limb retains its proper length: but when the ulna and radius are both fractured together, or the tibia and fibula in the leg, they then call the fracture complete, or even compound; though it would also seem that a fracture may be termed compound, when only a single bone is fractured in several places. But when a fracture of one or more bones is also attended with symptoms that require a distinct treatment, such as a wound, ulcer, &c. it is then termed complicated; because a particular regard must be then had to those concomitant disorders, during the cure of the fracture. But it is very evident, that a fracture ought not to be termed complicated, unless those symptoms are very severe; for no fracture can be made without some degree of contusion, and a slight inflammation almost constantly attends a fracture. Hence it follows, that a fracture is only to be termed complicated, when those concomitant disorders are so considerable, as to require a distinct treatment, or a different method of cure from that which is sufficient in a simple or compound fracture; as, for example, when a fracture is accompanied with a large wound, the same bandage cannot be applied as in a simple fracture, where the dressings may continue upon the part for several weeks; but such an apparatus is required as may be easily removed, for the dressing of the wound, without hazarding a fresh division of the fractured and reduced bone.

S E C T. CCCXLI.

NOW according to the different course of the fracture, it is also termed, either transverse, oblique, or longitudinal; and according to the fragments, pointing against, or pressing laterally upon each other; and according to the protuberant spines that arise, the fracture takes a different

different name and method of cure, as it acquires a different nature.

Fractures again acquire different names according to their different course or situation. A transverse fracture is when the bone is divided in a direction perpendicular to its length, being that species of fracture which our surgeons in Holland call *radys-breuk*, or a breaking short off like a stick; and the like term we also meet with among the antient Greeks, taken from the similitude of a broken stick or stalk, viz. *καυληδὸν κατάγμα* ^a; namely where the parts of the bone transversely fractured, entirely depart from each other, without any further cohesion. Hence this kind of fracture is also termed *ῥαφανηδὸν* and *σικυνηδὸν* by Ægineta ^b, from the similitude of a broken radish or cucumber. Hence also Hippocrates ^c seems to have used in the same sense the word *ἀποκαυλιῶσαι*, where he says, *ἢν δὲ καταγῆ ἢ κάτω γνάθῳ, ἢν μὴ ὑποκαυλιῶσῃ παντάπασιν, ἀλλὰ ξυνέχεται τὸ ὄστέον, &c.* *Si vero inferior maxilla frangatur, nec autem omnino transversim fracta fuerit, sed cohæreat os, &c.* “ But if the lower jaw is “ fractured, the fracture not being quite transverse, “ but the bone yet adheres, &c.” where it manifestly appears, that τὸ ὑποκαυλιῶσεν is used in opposition to τῷ συνεχεῖ.

Oblique.] Namely, when the division of the bone is not perpendicular to its length, but inclined either to one side or the other; by which means the fracture acquires a larger surface, and the fragments are more difficultly retained together, after they have been reduced.

Longitudinal.] Namely, when the bone is split according to its length, whence it may be rather termed a fissure than a fracture; because the parts of

^a Galen. Method. medendi, Lib. VI. cap. 5. Charter. Tom. X. pag. 143.

^b Lib. VI. cap. 89. pag. 96. versa.

^c De Articulis Textu, XXV. Charter. Tom. XII. pag. 342.

the affected bone are in this case seldom entirely separated from each other, but remain slit as it were in a right line, which species of fracture is therefore called by the antients *αἰδακκηδὸν*^d, or a division of the bone according to its length^e.

According as the fragments, &c.] For the fractured extremities of a bone may either continue in their natural situation, especially when the fracture is transverse; or else they may be a little displaced, so, however, as to remain partly in contact with each other; or lastly, the fragments may be wholly separated from each other, and recede to either side, which is almost constantly the case in oblique fractures, and sometimes also in transverse; but if the fragments are also sharp pointed, they may run through the integuments like thorns, which is certainly the worst species of fractures.

But it is necessary to attend carefully to all these different circumstances, not only for distinguishing fractures by their different names, but because their different nature requires a different treatment, and a better prognosis may be thence formed of the bad consequences which may be expected to follow.

S E C T. CCCXLII.

THE effects of a fracture are different, according to the particular nature of the fractured bone, and the different manner in which the fracture is inflicted, with the various condition of the fragments, as to their situation, figure, number, magnitude, &c. and lastly, according to the different nature of the adjacent parts, and of the part itself, in which the fracture happens.

^d Galen de Method. medend. Lib. VI. cap. 5. Charter. Tom. X. pag. 143.

^e Ægineta, Lib. VI. cap. 89. pag. 96. verfa.

The first consequence of a fracture, is an injury of all the functions which resulted from the continuity of the bone, and then follows a disturbance in the actions of the adjacent parts, which are either compressed or injured by the bony fragments. Hence it is very evident, that a great variety of symptoms may follow, from a fracture as the cause; and the difference of these symptoms will depend on,

The particular nature of the fractured bone.] As for example, the larger bones, such as the os femoris, os humeri, &c. have a cavity in which the medulla is deposited, but the clavicles, ribs, bones of the carpus and tarsus, have no such cavity full of marrow; whence a fracture of the larger bones must be always attended with an injury of the medulla, from whence the very worst consequences may follow.

The different manner in which the fracture is inflicted.] For a transverse fracture is the best, since the parts may be mutually applied to each other; but an oblique fracture is worse, because the extremities of the fractured bone more easily depart the one from the other. Whence Hippocrates^a, in treating of a fracture in the clavicle, observes that it may be more easily cured if fractured quite transversely; but more difficultly, if it is broken in a longitudinal direction. The difficulty of the cure will be also much augmented, if the fracture is accompanied with a violent contusion or wound.

Various condition of the fragments as to their situation, &c.] For when the ends of the bone remain in their proper situation in a transverse fracture, they do not injure the adjacent parts; or when they depart a little to either side, but in such a manner that the lower end as yet sustains the upper, there are no very bad consequences thence following. But when the ends of the bone, being removed from their natural situation, are forced up by the sides of each other, they will necessarily press and injure the ad-

^aDe Articulis Tex. LXXIII. Charter. Tom. XII. pag. 323.

jacent muscles, tendons, &c. and a much greater extension will be here required to reduce the fractured ends of the bone again to their natural situations.

Figure.] For the more acute the fragments, the more will they injure the adjacent parts; whence Celsus^b, in treating of the various kinds of fractures, pronounces, *Omne igitur os, modo rectum, ut lignum in longitudinem finditur: modo frangitur transversum: interdum obliquum: atque id ipsum nonnunquam retusa habet capita, nonnunquam acuta, quod genus pessimum est: quia neque facile committuntur, quæ nulli retuso innituntur; & carnem vulnerant, interdum quoque nervum aut muscolum:* “Every bone is therefore fractured, sometimes in a right line, like a piece of wood that is split longitudinally; sometimes it is broke in two, transversely, and sometimes obliquely; sometimes also the extremities of it are obtuse, and sometimes acute, which last is the worst kind of fracture; because the ends cannot be reduced together, having no support for each other, and because they wound the flesh, or sometimes injure the nerves or muscles.”

Number, magnitude.] The more numerous the fragments into which the fractured bone has been separated, so much the more danger is there of injuring the adjacent parts, and the more difficult will it be to retain the reduced bones in their natural situation: but the larger the fragments, the cure will be (*cæteris paribus*) so much the more easy.

According to the different nature of the adjacent parts, or of the part itself, &c.] The larger bones are very compact in the middle, but at their articulations their substance is spongy or cellular, formed by the departing of the bony lamellæ from each other: if therefore a bone is fractured near its articulation, it must of necessity destroy this cellular fabric; whence a great number of disorders may follow from the humours there extravasated and corrupted. But the li-

^a Lib. VIII. cap. 7. pag. 524.

gaments which connect the bones to each other, being inserted near their articulations, they will be likewise injured; whence an inflammation of them, and an anchylosis may follow. It was said before in the commentary on § 218. numb. 6. that a very considerable artery enters the tibia, through its upper and back part, frequently running for the length of an inch, in the midst of the substance of the bone itself: if therefore a fracture should happen in that part of the bone where the artery enters, a fatal hæmorrhage may follow, if the fracture is also accompanied with a wound; or else the blood, extravasated under the entire skin, may produce a spurious aneurism, and all the bad consequences that may thence follow.

If again the fractured parts are within the reach of a considerable nerve, artery, or vein, which run near the bone, it is very evident in what danger they are of being compressed or injured by the fragments, especially when they are sharp. Many bad consequences are also to be feared, if the tendons of strong muscles are inserted into the part of the bone fractured. All these circumstances are to be considered at the first dressing, and therefore the surgeon and physician ought not to proceed too hastily, but to consider well the nature of the part fractured, and compare it with those excellent tables of Eustachius; for unless the consequences to be feared are then predicted, they may be afterwards imputed to a mismanagement of those who are employed in the cure; thus, for example, a fracture of the os humeri near its articulation, by compressing or injuring the large nervous trunk there seated, may produce a palsy, a loss of sensation, or a-withering, &c. of the limb, which can be remedied by no means whatever. Hippocrates^c also diligently inculcates this admonition, in treating of those fractures where the fragments are forced through the skin; where he says, *Quibus vero femoris vel humeri os excessit, fere non evadunt, sunt enim ossa hæc*

^c De Fracturis Textu, XLVII. Charter. Tom. XII. pag. 257.

magna, & multam medullæ habent, & multa ac magna simul lacerantur, nervi, & venæ & muscoli. Quod si reponantur, solet nervorum distensio supervenire; si non reponantur, febres acutæ & biliosæ, & singultuosæ, &c. Magis adhuc evadunt, quibus inferior pars ossis, quam quibus superior excessit, &c. Multum quoque differt, si versus interiora os brachii vel femoris excesserit: multæ enim et magnæ venæ per interiorem partem feruntur, quarum nonnullæ vulneratæ hominem jugulant: per exteriorem vero partem pauciores incedunt. In ejusmodi ergo læsionibus non oportet oblivisci periculi, illudque in tempore prædicere: “ But those who have a fracture of the os femoris or os humeri very difficultly escape; for those bones are very large, contain much marrow, and at the same time lacerate many and large nerves, blood-vessels, and muscles. Even if they are reduced, a convulsion usually follows; and if they are not reduced, acute and bilious fevers, with hiccups, &c. ensue. But those are still more likely to escape, where the fracture is in the lower part of the bone, than when it is in the upper part, &c. The case will be also much worse, if the fracture of the os femoris or os humeri turns inward, because many and large vessels run by the inner side of the bone, some of which being wounded kill the patient, but along the outer side of the bone there are few vessels placed. In fractures of this kind therefore the danger ought to be remembered, and timely predicted.” Thus the worst consequences frequently follow after a fracture of the ribs, when the fragments lacerate the pleura, or even sometimes wound the lungs themselves, whence an empyema, and an incurable consumption, thence following. And a fracture of the calcaneum, into which is inserted the very strong tendon termed Achillis, is often followed with most acute and continual fevers, accompanied with a trembling, hiccup, and dilirium, which destroy the patient in a few days^d.

^d De Fracturis Textu, XXIII. Charter. Tom. XII. pag. 201.

S E C T. CCCXLIII.

THE chief consequences are therefore a destruction of the office of the bone, for sustaining or supporting and directing the muscles; whence a contraction of the muscles, a distortion of them from their proper places with a shortening, distortion, and deformity of the limb itself; a laceration, contusion, and corruption of the external and internal periosteum, of the vessels themselves seated in the spongy part of the bone, and also of the medulla with its including fine membrane; a luxuriancy of the vessels of the bone, whence a rough callous tumour, and deformity of the limb; a distraction, laceration, irritation, compression, and convulsion of the membranes, tendons, and nerves; an injury, obstruction, inflammation, and destruction of the adjacent vessels, pain, ecchymosis, withering, suppuration, gangrene, and death itself, of the part or of the whole body; but a contusion almost constantly attends a fracture.

This aphorism enumerates the principal disorders which usually follow after fractures of the bones.

A destruction of the office of supporting.] When we either stand or walk the whole weight of our body is sustained by the bones of the thighs and legs; whence it is, that these bones, being too flexible in ricketty children, are incurvated by the incumbent weight of the body. When therefore the continuity of the bone is removed by a fracture, this office of sustaining the body is immediately removed, unless the fracture should happen to be transverse, so that the ends of the bone, as yet retaining their natural places,

places, are sustained the one upon the other; but if in such a case the person walks, or moves the fractured parts, the ends of the bone will soon after be removed from their contact, and be incapable of sustaining the weight of the body. Parey^a being struck by the kick of a horse, fell down in his endeavouring to avoid farther injury, and both bones of his left leg being fractured, forced themselves not only through the skin, by the pressure which they received from the incumbent weight of the body, but they also perforated the boot itself, with intolerable pain.

Of sustaining and directing the muscles.] Most of the muscles in the body arise from, and are inserted into the bones; so that, if we except the sphincters, and muscular fibres of the vessels and viscera, we shall scarce find any muscle, but what has one end of it fastened to some bone. The bones therefore being fractured, the action and direction of the muscles fastened to those bones will be destroyed, or wonderfully perverted. When the patella is fractured, to which adheres the tendons of the muscles extending the leg, the direction and action of those muscles is then immediately disturbed; because it serves as a support to elevate and sustain their tendons. The same is also true of the other bones.

A contraction of the muscles, and a shortening of the limb.] Galen^b had in his time observed, that the muscles had in them a natural power of contracting themselves; and that this contraction did not proceed from the faculty of the mind, which moves the muscles; he proves by an experiment, *viz.* That a muscle transversely divided appears to contract itself towards each end, even after death. Vesalius^c has beautifully confirmed the same thing by experiments made on living animals; for when he totally divided the belly of a muscle, he observed that one part of

^a Livre XV. Chapitre 23. pag. 344.

^b De motu muscul. Lib. I. cap. 8. Charter. Tom. V. pag. 376.

^c Lib. VII. cap. 19. pag. 568.

the muscle contracted itself towards its origin, and the other part towards its insertion; and upon dividing the tendon of another muscle, he perceived that the muscle contracted towards its origin; or if he divided the head of the muscle, it contracted towards its insertion. But when he divided the muscle both at its origin and insertion, it then contracted towards its belly, and became globular in that part which was most fleshy. But it is the bones, to which the muscles are attached, which maintain them in this distention; so that when a bone is broken, the muscles become shorter by a spontaneous contraction, and draw up that part of the bone into which they are inserted; whence the limb becomes shorter, in proportion as the muscles, inserted into the lower fragment of the bone, are more strong and numerous. Thus if the *os humeri* is fractured above the place into which the *deltoide* muscle is inserted, it will be then contracted very strongly upwards; whence the arm will become shorter: for as Celsus^d observes, *Nam nervi musculique, intenti per ossa, contrahuntur*: “The nerves and muscles, which are kept in a state of tension by the bones, are then contracted.” The same is also true of a fracture in the *os femoris*, whence it is unanimously allowed by the consent of all surgeons, that a fracture in the upper part of the thigh bone, near the hip, is seldom curable, without leaving some defect in the motion of the limb; but when the same bone is fractured in the middle, or towards the knee, there are much greater hopes of obtaining a happy cure. This seems to follow, because the higher the fracture of the femur, the greater number of muscles draw up the lower part of the bone; and as those muscles are very strong, they require a very forcible extension, in order to replace the fragments, which are then also very difficultly retained in contact.

^d Celsus, Lib. VIII. cap. 10. pag. 532.

A disturbance of the muscles from their proper seats.] Most of the muscles arise from and are inserted into the bones, and frequently adhere for a very considerable length to the bones; if therefore a fractured bone should happen to be displaced; it will disturb the situation and course of the adjacent muscles, which arise from or are inserted into the fractured bone; and besides this, the fragments of the bone may disturb other muscles, which neither arise from nor are inserted into the bone fractured; inasmuch as the fragments will expel and displace all the circumjacent soft parts, which cannot be performed without a disturbance of the muscles, whence will follow,

A distortion and deformity of the limb.] The external surface of the human body is beset with various eminences and excavations, which arise principally from the muscles; variously placed, and being either contracted or relaxed, which is more especially obvious in robust men who are not over fat; but in women they are less conspicuous, whose bodies are therefore always more smooth and even. This is very well expressed by the painters and statuaries, when they represent the bodies of Hercules or Laomedon with strong arms, or the body of Venus smooth and uniform. So soon therefore as the muscles are displaced by the fracture of a bone, the figure of the parts is altered, and the natural shape of the limb is destroyed. Hence it is that skilful surgeons compare, for example, the arm or leg which was broken, with the arm or leg of the sound side; and by a strict attention they observe, whether both limbs have the same eminences and excavations, in order to determine whether the fractured bone is properly reduced. For the fragments of a bone, for example, of the humerus, may be adapted to each other, and cohere together, though they are not replaced in the same posture which they had naturally before; but then the deformity of the limb, in this case, will always demonstrate the error. The greatest deformity of this

kind, may follow after a fracture in the bones of the cubitus; for then the supinator and pronator muscles of the hand, commonly alter the natural figure of the parts in a surprising manner.

We come now to the disorders which happen to the bones themselves, after a fracture.

Of the external periosteum, the vessels running betwixt the bony cells, the internal periosteum, the membranes of the medulla, &c.] All the bones are invested with a membrane, which conveys vessels to and from the substance of each bone, and which is termed the periosteum, generally adhering very strictly to the bones. This membrane covers the external surface of the bones on all sides, except in those places where the ligaments arise from the bones, to invest and secure the articulations; for in these places the periosteum departs from the bone, and continues to run on over the ligaments, till it is inserted into and conjoined with the next bone; and in this manner does the periosteum pass from one bone to another, without any interruption of its continuity. The whole surface therefore of all the bones is covered with the periosteum, excepting those parts which are contained in the capsule of each joint, arising from the ligaments of each articulation. But it very rarely if ever happens, that the bones are broke within these ligamentary capsules, whence a fracture of the bone must always injure the external periosteum. Add to this, that we meet with a very surprising cellular fabrick in many of the bones; and the smaller bones which have no large cavity filled with marrow, such as the bones of the fingers, metacarpus, and carpus, &c. have their whole substance composed of bony cells. But in the larger bones, which have a considerable cavity in their middle filled with the medulla; these have their bony lamellæ very compact and closely united in the middle, but towards the ends of the bone they recede from each other, and form

• Clopton Havers Osteologia nova, pag. 17.

wonderful cells, in which the blood vessels and vesicles of the medulla are deposited. If therefore one of these larger bones is fractured at its extremities, this cellular fabrick will be destroyed, the vessels will be ruptured, and their juices extravasated; which by corrupting may produce a train of the worst consequences. Hence it is easily apparent, that a fracture of the bone may also destroy the internal periosteum with the fine medullary membrane, and the substance of the medulla itself; since these are so tender, that they break to pieces with a rough handling with the fingers, even in an old ox. But what severe maladies may follow from a corruption of the medullary oil, we shall hereafter declare more at large in the history of diseases in the bones. But certain it is, that all those parts will be lacerated, if the ends of the fractured bone recede from each other, or ride over the one upon the other; for then all the parts contained within the cavity of the bone must be unavoidably lacerated. It is indeed true, that the worst consequences, which are to be thence feared, do not always happen after a fracture; but it is evident, that they may sometimes follow, and therefore it is most adviseable for the surgeon to acquaint the patient, or rather his friends, that such accidents may happen; by which means he will prevent them from being ascribed to any want of skill or care in himself.

A luxuriance of the vessels of the bone, whence an inequality of the callus, with a tumour and deformity of the limb.] In the *Prænotiones Coacæ* of Hippocrates^h we meet with the following sentence, *Quodcumque os in corpore resectum fuerit, aut cartilago, non augetur*; "Whatever bone or cartilage in the body is divided, it will not grow or be nourished;" and in the aphorisms he subjoins also, *nec coalescit*, "that it will not unite or coalesceⁱ." After him Galen has also pronounced, that a bone can never unite

^h No 505. Charter. Tom. VIII. pag. 882.

ⁱ Sect. VI. Aphor. 19. Charter. Tom. IX. pag. 258.

with bone, nor cartilage with cartilage; for in a fractured bone there is an union of the parts by the intervention of a growing callus like glue, but not by a concretion of the divided parts themselves^k. But in his first commentary which he has writ upon Hippocrates concerning fractures, he has explained this matter more at large^l, where he says, *Quum ossa ob siccitatem naturalem non possint carnis instar coalēscere, quasi vinculum quoddam illorum callus fit, circumcrescens fracturæ labiis. Originem vero ei (callo) dat superfluum ipsius ossis fracti nutrimentum. Et quando decumbens non utitur idonea victus ratione, vel etiam plethoricus est, illud superfluum copiosum est, effusumque totas fascias velut effuso sanguine madefacit;* “As the bones
 “ by their natural dryness cannot grow together like
 “ flesh, therefore a callus growing round the margin
 “ of the fracture forms a sort of vinculum or con-
 “ nexion. But the origin of this callus is from the
 “ superfluous nourishment of the bone itself; and
 “ when the patient does not use a proper regimen, or
 “ is of a plethoric habit, that superfluous nourish-
 “ ment is very copiously discharged, so as to wet or
 “ moisten all the dressings or bandages in the manner
 “ of extravasated blood.” From hence he seems to think, that the callus does not arise from the proper substance of the bone itself, but that the bone is conjoined by the intervention of a kind of glue, interposed betwixt the fragments; for a little afterwards he subjoins, *Quale enim unitis lignis gluten est, tale ossibus fractis callus;* “For the callus is to fractured bones
 “ the same as glue to pieces of wood united.” But since it cannot be denied, that the callus in time acquires the same hardness with the bone itself, and as Galen did not believe a callus to be capable of putting on the nature of bone, it seems surprizing when he expresses himself in the following words: *Quidquid igitur ex eo, dum effunditur, circa fracturæ labia con-*

^k Galen de Meth. Med. Lib. V. cap. 7. Charter. Tom. X. pag. 113.

^l Charter. Tom. XII. pag. 179.

crefcit, illud, tempore mutatum ab offe contiguo, illi fimillimum fit, & callus nominatur; “Whatever then concretes about the margin of the fracture, while it tranfudes from thence, the fame being changed by time, becomes very much like the bone itfelf, and is denominated a callus.” Whence it appears, that he would have the name of callus continued, even after it has acquired the hardnefs of a bone. After Galen, moft people feem to have been of the fame opinion. But we have already feen in the commentaries on § 158. numb. 9. that the loft fubftance is regenerated in wounds, and the divided parts united, not by the intervention of glue, but by a true regeneration of the loft flefh, formed by nature from good blood brought to the parts; as Galen himfelf has truly affirmed in the place there cited. It alfo evidently appears in the hiftory of wounds in the head, that the part of the fkull, which is removed by the wounding inftrument, or cut out by the trepan, grows up again. The fame therefore feems to take place in fractures of the bones, namely, that they conjoin not by the interpofition of any glue, but by a fubftance truly of their own; and in thofe cafes, where part of the bone is removed, there is not a thick humour interpofed betwixt the fragments, which gradually hardens, but the organical fabrick of the bone itfelf is reproduced, and repairs the loft fubftance. This truth is very well confirmed by chirurgical obfervations. A man being loaded had the tibia and fibula fractured by a cart-wheel paffing over his leg, which lacerated all the adjacent parts in fuch a manner, that nothing lefs than an amputation of the limb could be thought of. But the fragments of the bones being replaced, and proper means ufed, the fibula was perfectly united after two months time; but a confiderable fragment of the tibia was feparated to the length of four fingers breadth, in which the groove of the medullary cavity was confpicuous; fo that a large hiatus or fpace was left betwixt the two

ends of the fractured tibia. But yet this whole space was in ten months time filled with a substance so compact and firm, that the man could afterwards commodiously use his leg^m. But does it seem credible, that a glue, arising from the superfluous nourishment of the bone, and transfusing from its own fractured extremities, could thus elongate the bone exactly without any deviation, so as to fill up so large a space? Or rather ought not this to be ascribed to that wonderful property received by the human body from its adorable Creator, by which it is able to restore the loss of substance, and increase the dimensions of all its parts already formed by changing its aliments into its own nature through the action of the vessels and viscera? Certain it is, that the vital rudiments concealed in the sacculus of colliquamentum in a fecundated egg, does in the space of one and twenty days build up the whole created fabrick of its little body, and forms such solid bones from the soft albumen, as not only enables the chick to stand, but also to run about soon after it is hatched. The same mechanism therefore seems to take place in the bones, with respect to the reproduction of their lost substance, and their concretion after a fracture, as we observe to happen in wounds of the soft parts; namely, that there is an organical reproduction of the lost substance, and a true concretion without any agglutination by the interposition of a shapeless glue.

Now as in wounds of the soft parts the repullulating vessels, which are so minute and soft, may be too much distended for want of the confining skin, so as to degenerate into a fungous flesh; the same is also true with respect to the callus of a bone, which may be luxuriant in the same manner, if the juices are discharged too copiously, or if the vessels are too forcibly distended beyond what is necessary for reproducing the substance of the bone, and this is more

^m *Traité complet de Chirurgie, par M. de la Motte, &c. Tom. IV. pag. 284, &c.*

especially to be feared in younger subjects, whose solids are always more weak and infirm, and their fluids more redundant, and generally move with a quicker circulation. From hence it is, that surgeons have so often observed a luxuriancy of the callus in young patients, especially after using a plentiful diet; but then this accident must be necessarily attended with an inequality and alteration in the figure of the part. But the deformity of a limb happens still more frequently, when the two ends of the fractured bone are pressed against each other before the callus has acquired sufficient firmness; for then the callus is pressed out on all sides like soft wax, and forms a protuberant ring round the fractured part of the bone. This accident also more especially happens when the patient walks too soon upon the fractured bones either of the legs or thighs; for the weight of the body pressing on the bones forces out the callus, if it has not yet acquired its bony hardness.

A distraction and laceration of the membranes, tendons, and nerves.] Which more especially follow, when the ends of the bones ride over each other, and still more if the ends of the fragments are sharp pointed; for then they prick and lacerate all the circumjacent parts. It has been observed under the present aphorism, that when Parey had the misfortune of his leg broken while standing on it, the fragments of the bone not only pierced through the skin and muscles, but even through the boot also with intolerable pain. But what dangerous consequences are to be feared, from the membranes, tendons, and nerves being injured or irritated, has been already said in the commentaries on § 162 to 166, and 181 to 185. Such lamentable consequences sometimes follow in these cases, that Hippocrates advises the physician to avoid them, when he can do it without prejudice; since there are here but few hopes and the greatest danger: *Si enim non reponantur ossa, medicus videtur*

ⁿ Hippocrat. de fracturis, Text. L. Charter. Tom. XII. pag. 259.

arte destitui, si reponantur, homini magis ad interitum, quam ad salutem est; “ For if the bones are not re-
 “ placed, the physician will seem incapable of his
 “ art; and if they are replaced, the patient will be
 “ advanced nearer to death than recovery.”

An alteration and destruction of the adjacent vessels.] The worst accidents, that usually follow fractures, seldom proceed from the injury of the bone itself, but rather from the injury offered to the adjacent soft parts, which are compressed or wounded by the bony fragments. Great numbers of vessels then are injured, which are either seated in the substance of the bone or in the adjacent parts, liable to be compressed or injured by the displaced fragments; whence Hippocrates observes, (as we said under the preceding aphorism,) that it is of great moment to know, whether the bones of the arms and thighs are displaced inwards or outwards, because many and large vessels run along the inner sides of those bones. Among the causes of obstruction (§ 112.) we enumerated every thing capable of rendering the flexible canals narrower by an external compressure or extension; it is therefore evident, that obstructions must frequently follow fractures of the bones. And though the course of the humours through the narrow vessels be not totally intercepted, yet many of the functions of the body may be thence surprisngly disturbed various ways; since the due performance of those functions result in a great measure from the just proportion of amplitude, which the trunks and branches of the vessels have with respect to each other. If now to an obstruction of the vessels we add an increased circulation of the humours arising from a fever, an inflammation will be formed, which may produce all its consequences, as suppuration, gangrene, sphacelus, &c. The severe pains also in fractures arise, not so much from the injury of the bone, as from the great distention of the membranes, tendons, or nerves; as may in a great measure appear from the entire cessation or
 great

great diminution at least of the pains, after the bones have been reduced into their natural situations. When vessels are divided under the entire skin, or but slightly wounded, the blood escapes, and being collected in the panniculus adiposus, forms an ecchymosis, as we observed in the history of contusions. But when the trunk of a large artery or nerve, descending to the subjacents, is so compressed or injured that it can no longer transmit any thing, the subjacent parts are then deprived of all vital influx, and are either corrupted with a gangrene, or are slowly dried up or withered; as appears from the remarkable case we related of the man, who had the trunk of the axillary artery totally divided, whence his arm remained all his life-time afterwards dried up like a mummy. See the comment on § 161.

But death sometimes follows fractures of the bones, from the excruciating pains, severe fever, delirium, convulsions, &c. or if a gangrene invades the injured part, which turning to a sphacelus, ascends to the superior parts, and after restlessness, delirium, syncope, hiccups, &c. the patient at last expires in a pleasant sleep.

Almost constantly a contusion.] For the external violence cannot dissolve the continuity of the bone, unless it also acts upon the soft parts incumbent on the bone; and these soft parts being pressed betwixt the hard bone and the injuring cause, must necessarily be contused. There will be therefore always some contusion in every fracture, unless the bones become so friable by the venereal disease, the rickets, scurvy, or the like, that they may be fractured by a very slight force. But this is a symptom that ought always to be well considered in fractures, for there are many bad consequences which arise from the contusion, even after the bone has been happily replaced: whence Hippocrates ° (enumerating many of the accidents which follow usually from fractures and luxations)

° Textu LXII. Charter. Tom. XII. pag. 268.

lays it down for a general axiom, that more is to be feared from the contusion, than from the fracture itself. For he says, *Leviora autem, ut summatim dicantur omnia, sunt vitia, quibus ossa franguntur, quam quibus ossa quidem non franguntur, venæ autem & nervi natabiles conteruntur in iisdem locis. Hæc enim hominem magis ad interitum præcipitant, quam illa, si continua febris accesserit*: “ For the symptoms are in short all
 “ of them slighter when the bone is broke by the
 “ force, then when it remains whole, for the consi-
 “ derable vessels and nerves are crushed in those
 “ places, where the injury is received: and this con-
 “ tusion accompanied with a continual fever, hurries
 “ the patient to his end sooner than a fracture.”

Therefore those remedies are often necessary to be used in fractures which are proper in the cure of contusions. For though the just replacing of the fragments, and the retention of them in their proper places, seems to satisfy the first or general intention, and may appear of themselves sufficient in the judgment of many surgeons, yet it is very apparent from what we have before said, that a different method of treatment will be required according to the various accidents which accompany the fracture.

S E C T. CCCXLIV.

FROM a consideration of all which (342, 343.) we are informed of the existence and nature of a compound fracture: to which if we add, the examination of the fragments by the touch; their crackling or grating against each other, sensible to the ear; the deformity and immobility of the limb, evident to the eye; with a knowledge of the cause, its degree of violence, and the manner of its acting, or whether it was assisted by the winter's cold, a decrepid old age,
 or

or a morbid temperature; from considering all these at the same time, the diagnosis of the fracture will be still more evident.

This aphorism describes those signs, by which a present fracture may be discovered. For there are sometimes accidents of this nature, in discovering which the most skilful surgeon may find much difficulty. Most places are furnished with a set of people who call themselves bone-setters; who though they are for the most part very ignorant, endeavour to persuade the common people, that they understand the art of restoring fractured or dislocated limbs, even better than the surgeons themselves. These generally lay the fault of almost all disorders of the limbs either to fractures or luxations, and have immediate recourse to the application of the whole apparatus usual in those accidents; by which means they often defraud the patient, and hinder him from his business without any real necessity. By these impositions they conceal their ignorance, and make those who are unskilled in these matters believe they have performed wonders. But it is the business of a prudent and honest person, to use his utmost endeavours to know whether there is any real fracture or not. The diagnosis of a fracture is indeed easy, when the fragments of the bone are removed from their places, and run up by the sides of each other, or even force themselves through the skin; but when the fragments remain contiguous, or are so little displaced, that they sustain each other, and the fractured bone itself is covered on all sides with strong muscles, as in the thigh; the fracture in that case is much more difficult to discover. The same difficulty is also frequently observed in discovering a fracture in the cubitus or leg, when only one of the two bones, seated in those limbs, happens to be broken; as also when the surgeon is called later than he ought to have been,
and

arm, the os humeri broke transversely about four or five fingers breadth below the shoulder. Upon removing the dressings three days after the bone had been set, the physician and surgeon, who began to be pleased with the seeming success, upon a narrow inspection found another fracture of the same bone, near the elbow, and this they also immediately dressed with a suitable apparatus. But in another epistle writ from the same physician to Hildanus, about six months after the accident, there is an account that they had in vain waited two whole months in expectation of a callus to be formed for uniting the bone; and that the man dying afterwards of an inveterate ulcer in his kidneys, they found the os humeri wholly corrupted with a caries. Another case of the like nature is also related by the same author^c; viz. of an honest woman near sixty years old, who had her os humeri fractured in bed, without any external violence, while she was endeavouring to raise her body, and put on a clean shift. This fracture was afterwards cured by proper assistance; but when she was about to get up after so long a confinement to her bed, the maid assisting to put on her stockings, unfortunately broke her right leg transversely. The surgeon being called, made a cure likewise of this fracture in the usual manner, without much difficulty. In this manner she survived, suffering various fractures, for the space of two years, at the end of which time she expired with excruciating pains. There seems to have been nothing of the venereal disease in this case, because the husband never found himself disordered; and they had ten children in perfect health; nor was there ever any occasion in the least to suspect the mother's honesty. Hence it is evident, that a friability of the bones may sometimes arise from latent causes, whence they are often fractured by a very slight force.

^c Centur. 2. Observ. 68. pag. 141.

S E C T. CCCXLV.

BUT it is more difficult to discover an oblong fracture, till after some delay; yet the pain, tumour, thickness, and inequality of the part, with the discharge of a foul matter, and the known violence of the cause, will afford some light towards the discovery.

A fracture is said to be oblong, when a bone is split according to its length by some external violence, like a slit in a piece of wood. Such a fracture is very difficultly discovered, unless it should happen in a part where it lies almost naked to the touch, as in the anterior part of the leg, where the os tibix lies sufficiently exposed throughout its whole length, to be examined by the fingers; but in other parts of the body, a person cannot easily distinguish a longitudinal fracture. In reality, the worst consequences may follow such a fracture; which consequences then denote too late that such a fracture is present. For in a bone thus split, the vessels running through its substance are broke, and their juices extravasated, whence they putrefy and induce a caries of the bone; or they may also inflame and suppurate the parts incumbent on the bone. The principal signs of such a fracture, if a cause sufficiently violent is known to have preceded, are, the attendance of a deep and lasting pain, with a tumour or elevation of the parts incumbent on the bone, and extending itself according to the length of the bone. If after this the integuments break and discharge a foul matter, there will be still greater reason to suspect that the subjacent bone is injured. But even all these signs are doubtful enough, since they frequently follow a violent contusion, though unaccompanied with any such fracture: it is true, the discharge of a foul

manner denotes too late that the bone is corrupted; whence the timely diagnosis of this kind of fracture is very difficult. But even the discovery of such a fracture to be present, would not conduce much to the benefit of the patient; for what can art perform, in such a case, when all the parts retain their situations, and only the bone is injured? Some body will perhaps answer, that phlebotomy, with discutients, antiphlogistic fomentations, a thin diet, *etc.* are to be used, to prevent an inflammation, suppuration, and all their consequences. But the contusion, which always accompanies this sort of fracture, will require those means, even though the bone be not injured. In the history of wounds in the head, we directed how a fissure of the skull ought to be treated; but then can other bones split longitudinally in that manner be safely denudated, so as to be either scraped away by the rasp, or bored through with many small foramina? If the thigh bone is known to be thus fractured, who will dare to cut through the strong muscles which invest it, in order to make a way for his hand to the affected bone? This method of cure can be therefore performed in but a few parts of the body, where the bones are only covered with the common integuments; but then in those places it is also much more easy to discover this injury. In the other parts of the body, therefore the knowledge of such a kind of fracture must be very difficult to obtain, and of no great use if known; since no other means can be used, besides the general remedies proper for all contusions.

S E C T. CCCXLVI.

THAT the cure will be either easy or difficult, quick or slow, compleat or defective, may be predicted from the figure, simplicity, or complication, and age of the fracture; as also
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from the number, figure, and magnitude of the fragments; the particular place of the bone fractured, the adjacent parts injured, with the season of the year, and the age and habit of the patient.

This aphorism treats concerning the prognosis of fractures, which indicates the bad consequences to be feared, or the good events to be hoped for. Therefore all the effects of fractures, enumerated in § 343, are to be here considered, and after a strict examination, we may then conclude (from the known nature of the fracture, with an anatomical knowledge of the parts) whether the cure will be easy or difficult: but the cure is said to be easy, when it can be performed without any great endeavours of art, and without much trouble to the patient; and it is said to be difficult, when the contrary obtains. In the next place, it ought to be determined whether a long or a short space of time will be necessary to restore the bone to its due firmness and continuity. And lastly, it must be enquired whether the cure may be expected to succeed so well, that the broken limb will recover the strength, form, and action which it had before; or whether any sensible defect will remain after the cure, so as either to disfigure the injured limb, or else impede or destroy its action. But in doing this great prudence is necessary; for generally the remaining defects are imputed to the fault of the surgeon, to his great prejudice, if he does not foretel them. For though an honest surgeon ought not, like a pretending quack, to magnify a small injury, that he may be thought to have done great matters; yet prudence requires of him to mention the bad consequences to be feared, lest he should be thought ignorant or incapable in his art. If a surgeon who is too fearful, makes a bad presage in a slight case, frequently another is called to undertake the cure; and

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if he succeeds, it injures the character of the former. Nor will it be less prejudicial to promise a happy cure, and the event proves bad. But to form a safe prognosis, attention must be given to the following particulars.

Figure of the fracture.] That kind of fracture is of all the best, which is termed transverse or raphanoide; especially if the fragments as yet sustain each other, and are not quite displaced. But the cure of an oblique fracture is much more difficult; because in that the fragments do not mutually sustain each other, and they are very easily displaced or removed from their contacts by the contraction of the muscles fastened to the bones, nor is it easy to secure the parts so by bandage, that the fragments shall continue in their proper places after they have been reduced. Celsus^a, treating on fractures, has very well expressed this; for he says: *Earum maxime tolerabilis est simplex, eaque transversa: peior, ubi obliqua, atque ubi fragmenta: pessima, ubi eadem acuta sunt*: “Of these fractures, the most tolerable is the simple and transverse; but it is worse when the fracture is oblique, and when there are fragments; and the worst of all, when those fragments are sharp pointed.”

Simplicity or complication.] It is very apparent, that the cure must be much more difficult when the bone is fractured in several places; and the more so, if the fractured places are so distant from each other, that they cannot be invested by one and the same apparatus, but each fracture must have its particular dressings. A remarkable case of this nature is given us by Le Motte^b, of a man who broke his leg both towards the ancles and the knee: after both fractures had been dressed with a convenient apparatus, the uppermost continued well enough, but the lower fracture had such severe pains, as made it necessary to treat it afterwards with the foliated bandage, in the

^a Lib. VIII. cap. 10. pag. 530.

^b Traité complet de Chirurgie, Tom. IV. pag. 254, &c.

manner of a compound fracture. But if the fracture is complicated, as well as compound, that is, if it be accompanied with a wound, contusion, inflammation, *etc.* you will foresee the cure to be still more difficult.

Age of the fracture.] When the parts of the fractured bone continue in their natural situations, there is no great danger to be feared from the long continuance of the fracture; because art can do nothing more in that case, than prevent the fragments being displaced, by the application of a suitable apparatus. But where the fragments no longer sustain each other, but ride over or slip up by the sides of each other, then the distraction and laceration of the parts is the greater, in proportion as a longer time has elapsed since the fracture; whence enormous pains, inflammation, tumour, *etc.* usually follow; and in that case it is impossible to reduce the fracture before those symptoms are removed, or in some degree mitigated. For if a part thus violently inflamed and swelled was to be roughly handled, it would soon be invaded with a gangrene; or from the great severity of the pain, convulsions might follow. But when the bone is exposed naked in a compound fracture, or if a fragment of the bone starts through the skin, in that case the cure may be reasonably expected to succeed more slowly and difficultly, as the parts have been longer exposed to the air; because here it is often necessary to wait for an exfoliation of the diseased part of the bone; as is evident from what has been said on this subject, in the history of wounds of the head, § 249, 250.

The number, figure, and magnitude of the fragments.] The more numerous the fragments, the more difficult will it be to retain them in their proper situations, after they have been reduced; which will be also the more difficult, as the fragments are less: as for example, if the os humeri is fractured in two places, so that a piece of its middle is separated, to the length of three fingers breadth; such a fracture,

though ever so well reduced, would be very difficultly retained in its proper situation, since the contraction of the muscles, and the pressure of the splints and bandages, would be very apt to displace the fragments. Such a fracture would therefore require a machine capable of retaining the limb in its due extension; and as such fractures require the most formidable assistances of art, they cannot be termed easy to cure. In such like fractures, Hippocrates^c recommends the use of two cylinders, or round plates of Turkey leather, like what is used by those who are a long time confined in heavy fetters; and in a fracture of the leg, he directs to apply one of them above the ancles, and the other below the knee. These plates are to be furnished with loops on each side, of single or double leather; in such a manner that the loops of the upper plate may correspond to those of the lower: he then introduced splints of horn of a due length into those loops, which held the leathern plates extended to their due distances. Thus did Hippocrates maintain the limb at its due length, and preserve the fragments from being displaced at the same time; and in the same place he describes at large, what more is necessary to be observed in the application of the plates. But when the fragments are sharp pointed, the case is very difficult to cure; because the fragments greatly injure the adjacent parts, and are difficultly retained as well as reduced, as we said before in the comment on § 342. It also appears from chirurgical observations, that the division of a bone made by a sharp or cutting instrument, cannot be cured in so short a space of time, as a fracture by a blow with an obtuse instrument; which seems indeed wonderful. But the reason may perhaps be this, that a common fracture has always some eminenties or asperities, which retain the bones more firmly together, after they have been rightly reduced, so that they can the better unite, and the fragments

^c De Fracturis Textu, 29. Charter. Tom. XII. pag. 246.

are not so liable to be moved or rubbed against each other in coughing, sneezing, or the like motions; which attrition must destroy the repullulating callus, or at least retard the union of the fractured bone. But when a bone has been divided by a cutting instrument, the surface of the fragments is smoother, and they are more liable to be moved or rubbed against each other. There are three or four remarkable cases, in confirmation of this, to be found in the observations of the deserving Le Motte^d, who affirms, that an incised fracture, even a simple one, takes double the time in the cure, which a common or even a bad complicated fracture requires, except those which have a considerable loss of substance or a violent contusion of the bone into small splinters.

The part of the bone injured.] It was said in the commentary on § 342. that fractures have various consequences, according to the different part of the bone that is injured. Celsus^e enumerating some of the effects common to fractures of the arms, thighs, legs, and fingers, says, *Siquidem ea minime periculose media franguntur: at, quo proprior fractura capiti vel superiori, vel inferiori est, eo peior est. Nam et majores dolores adfert, et difficilius curatur*: “That they
“are indeed broke with the least danger in the mid-
“dle; but the nearer the fracture is to the upper or
“lower head of the bone, it is so much the worse;
“for it then occasions greater pains, and is more dif-
“ficultly cured.” For the larger bones are the hardest in their middle; but in their extremities, which are articulated to the next adjacent bones, they are cellular and friable. The difficulty is also still augmented by the adjacent ligaments of the articulations which connect the bones. There is also much difference betwixt a fracture in the upper or in the lower end of the bone, as we demonstrated from the testimony of Hippocrates in the commentary on § 342.

^d Traité complet de Chirurgie, Tom. IV. pag. 303—318.

^e Lib. VIII. cap. 10. pag. 530.

Thus Hildanus^f has observed, that if the os femoris is fractured near its articulation with the hip, the fracture can hardly ever be cured without a halting of the limb remaining; but that when the same bone is fractured in the middle or towards the knee, it may be often cured by an expert surgeon without any defect remaining. And in the same place he confirms his assertion by the testimony of many considerable authors.

The adjacent parts injured.] Concerning these, see what has been said in the commentaries on § 342.

Time or season of the year.] Hippocrates^g has pronounced warmth to be very friendly to fractured bones, especially if they are naked; but cold, he says, is an enemy to the bones^h: and therefore the cure of a fracture will (*cæteris paribus*) succeed less prosperously in winter than in summer. But in the summer heats there is greater danger of a putrefaction; and therefore a cure may be expected to succeed the most happily in spring and autumn.

Age of the patient.] The nearer a person is to the birth, the more speedily does a fractured bone unite; and in extreme old age a fracture either not at all unites, or at best but very slowly: but in younger subjects there is more danger of a luxuriancy of the callus; which makes a middle age seem to be the best. The eminent surgeon Le Motteⁱ ingenuously confesses, that he had twice met with the misfortune of breaking an arm in extracting the foetus by its legs in difficult births; but then they were easily cured by a slight apparatus in twelve days time, whereas in adults, who are in health, a fracture requires at least thrice that time to be consolidated.

Habit or temperature.] All those disorders, which either consume or corrupt the fat of the body, occa-

^f Centur. V. Observ. Chirurg. Observ. 86. pag. 475, 476.

^g Aphor. 22. Sect. V. Charter. Tom. IX. pag. 207.

^h Ibid. Aphor. 18. pag. 204.

ⁱ Traité complet de Chirurgie, Tom. IV. pag. 171.

sion fractured bones either not to unite at all, or at least but very slowly; and therefore fractures are hardly curable in the worst stages of the venereal and scorbutic diseases, and in the rickets, consumptions, *etc.* as appears from the instances which we mentioned in the commentary on § 344. But there is perhaps such a latent disposition in the habits of some people, which prevents the bones from easily uniting, even though no remarkable cacochymy or other visible disorder attends. The celebrated Ruyfch^k asserts, he has met with such a case, where the bones would not unite, even though all the proper rules of art were observed towards obtaining a cure. And in his observations anatomical and chirurgical^l he relates, that in the body of a man, who was hanged in full health, he found two of the anterior bones of the carpus not yet conjoined, even though they were fractured three years before. I have myself seen a woman, who having broke her arm, it was afterwards reduced according to art, but it never united, even though she was in the flower of her age; whence her arm remained flexible in the part where it had been broken during her whole life-time afterwards, which was yet no great inconvenience to her. It is an observation made by Hildanus^m, that the consolidation of fractured bones succeeds very difficultly in women with child; and he relates the case of a fracture in the middle of the tibia in a woman, who had passed the seventh month of her pregnancy, but the fragments were not united, though three and twenty weeks were elapsed since the fracture; but at length in the thirtieth week the cure was completed. But in this woman the fracture was attended with a considerable wound, and some fragments of the bone came away; whence it may be perhaps judged, that these accidents rendered the cure so slow and difficult. But he has in another placeⁿ gi-

^k Advers. Anatom. Decad. 2. n^o 2. pag. 6.

^l Observat. IV. pag. 8. ^m Centur. V. Observ. 87. pag. 484.

ⁿ Centur. VI. Observ. 68. pag. 582.

ven a very remarkable history, which confirms the difficulty of curing fractures in women with child. A woman of quality, of a corpulent and plethoric habit, endeavouring to mount a horse, broke her left tibia betwixt the knee and the ankle: the fracture was happily reduced the same day by Hildanus, who neglected nothing that might forward a successful cure; and as no pain, nor any other bad symptom appeared, he hoped that the cure might have been completed within the space of two months. When the fortieth day came, the callus was found soft and slippery; but as the patient had hitherto suckled an infant, she was ordered to wean it; in a little time after she appeared to be with child, and was happily delivered of an healthy and strong girl seven months after the fracture was received. The fractured bones could not be united, during the whole time of pregnancy, by all the means that were tried; even though the lady's impatience and continual complaints of the slowness of the cure excited Hildanus to use the utmost diligence and industry. Yet within thirty days after her delivery the callus became firm, and the limb recovered its former use and soundness. Hence he concludes, that nature being fully employed in forming and perfecting the foetus, in a manner neglected to form a callus. Observations of the like nature, in confirmation of this, may be seen in the *miscellanea curiosa*°. But we are in the same place furnished with the history of a woman, who having broke her left knee-pan in the fifth month of her pregnancy, was nevertheless so well cured in the space of six weeks, that she could walk about the house with some difficulty. Hence, therefore, though it does not seem to be an universal conclusion that fractures of the bones in women with child will not unite before the birth; yet it seems adviseable in these cases to mention the difficulty beforehand, lest the slowness of the cure should be af-

° Decur. 1. A. 1. Observ. 25. pag. 91.

terwards imputed to some fault in the surgeon or physician.

S E C T. CCCXLVII.

THE cure of a fracture requires, 1. A restitution of the parts into their natural situations by extension and reduction. 2. A retention of them in that position by bandages and machines or instruments. 3. A consolidation of the united and retained fragments by the growing up of a callus.

We have here the general method of cure common to all fractures. But every cure is the producing of such a change in the parts of the living body, as will remove the corporeal effect, termed the disease, (see the comment on § 4.) and likewise restore that, whose absence produced the disease. Now in a fracture there is always a removal of the continuity of the bone, and generally a change in the natural situation of its parts; whence it evidently follows, that the cure will require first a restitution of the divided parts to their natural situations, and then a consolidation or union of them; both which may be obtained by the means described in the three numbers of this aphorism.

1. When the situation of the parts has been altered, an extension is always required before the fragments of the bones can be safely reduced. For the surfaces of the fragments are generally rough and unequal; whence, if the reduction was to be attempted without an extension, the fragments would grate against each other, and break off some splinters or asperities, which interposing betwixt the fragments, would either retard their consolidation, or being thrust out into the adjacent soft parts, they would irritate and injure the membranes, tendons, *etc.* as Fabricius
Aqua-

Aqua pendente has very well observed ^a. Add to this, that the muscles contract themselves (as we mentioned in the comment on § 343.) so soon as the cohesion of the bone is removed, which directs and sustains them; whence an extension of them appears to be necessary before the fragments can be replaced.

2. After the bones have been reduced to their natural situations, that alone would suffice, if the part could be retained without motion by the influence of the will; but as there are frequently very considerable commotions produced in the body, either without the patient's knowledge, as in sleep; or without his inclination, as in sneezing, coughing, laughing, *etc.* by which means the replaced bones might easily be disturbed from their situations; for this reason therefore, bandages, compresses, splints, and other machines are required, according to the nature of the part injured, to retain the limb firm and immoveable. It is frequent with many patients, for the first two or three nights after the fracture is reduced, to pull up the affected limb suddenly in their sleep, in a manner as if it was convulsed; whence they usually awake in a fright: now if in such a case the limb was not properly secured, the reduced fragments would be removed, and require to be replaced again. This is what Parey ^b laments to have happened to himself, that while he was sleeping in the night-time, his broken leg so forcibly started up of a sudden, that the fragments were displaced; whence a new extension and reduction was necessary; and which were performed with much greater pain than at the first time.

3. It was demonstrated in the commentaries on § 343. that the fragments united and grew to each other, not by the interposition of a glue, which by its cohesion fastened the ends of the bone together, but by a true union of their substance, in the same manner as in wounds of the soft parts, there is a union

^a Oper. Chirurg. Lib. IV. de fracturis, cap. 3. pag. 328.

^b Livre XV. Chapit. 25. pag. 346.

of the divided parts and a reproduction of the lost substance. From whence it is very apparent, that art can do nothing in this respect, but that the nature and fabrick of the human body only performs the whole, while healthy juices are distributed in a due quantity, and with a proper force through their respective vessels to the parts injured. All therefore, which has been said concerning the regimen and diet proper for the cure of wounds in general, is here applicable. And hence it is, that fractured bones are observed to unite so soon in infants; and so very slowly or not at all in those of a decrepid old age: because the younger the patient; or the nearer to its birth, the faster it is observed to grow or increase. Hence Hippocrates^c justly pronounces, *Aluntur quædam ad incrementum, et ad essentiam; quædam ad essentiam solam, ut senes: quædam præterea et ad robur*: “Some are nourished
 “ so as to increase their body, as well as preserve it;
 “ and others only so as to preserve it, as in old peo-
 “ ple: some again are so nourished as to acquire
 “ strength also.” From hence it is sufficiently evident, that viscid aliments conduce nothing to the formation of a callus, such as the decoctions of the several sorts of corn, and the jellies of animal substances, which are recommended by *Fabricius ab Aquapendente*^d: but that these will be rather prejudicial, as they are so difficult to digest, especially in quiescent bodies, where they occasion a spontaneous glutinosity, first in the *primæ viæ*, and then in the blood, as we demonstrated in the commentary on § 69. *Hildanus*^e tells us he observed a man of forty years old of a good habit to fall into a cachexy by such a viscid diet, which was prescribed to him by an empiric; whence he was afterwards troubled with a jaundice, accompanied with other bad symptoms, and at length he perished of a dropsy. Nor can we expect the use

^c De Alimento Text. 45. Charter. Tom. VI. pag. 293.

^d Opera Chirurg. Lib. IV. de fracturis, cap. 6. pag. 335.

^e Centur. 1. Observ. Chirurg. Observ. 92. pag. 71.

of the so much praised lapis osteocolla to conduce any thing more to the formation of a callus, because its hollowness and similitude (having a cavity like that in which the medulla is deposited in the middle of the bones) has made some people imagine it a specific medicine for the bones; which it also resembles in its spongy texture and friability. It is indeed evident, that this earthy and unactive medicine may be safely administered; but that it has any such efficacy towards the production of a callus, hath not yet appeared. Hildanus^f indeed extols the virtues of it, and ascribes to it his happy success in the cure of a fracture of both bones of the leg in a man of forty years old of a bad habit; and he also ascribes the too great luxuriance of a callus to the imprudent use of this stone in a healthy lad of fourteen years old of a sanguine habit. But we very well know, that even very bad fractures are happily cured in adults without the use of this stone; and we also know that the callus abounds in younger patients. But though Hildanus ascribes his happy success as above solely to the use of this stone, yet we find that he had recourse to other more efficacious helps, when he found nature languishing in the body of an old patient^g. Namely a decrepid old man of seventy received a compleat fracture of the bones about the carpus by a blow with a stick; and many years before he had been troubled with a palsy of the same side, which was not yet entirely removed. After replacing the fragments, Hildanus being obliged to undertake a long journey, left the rest of the treatment to his servants; but returning again after a month, upon examining the part fractured, he found by the grating of the bones that they were not yet united by a callus. After ordering a very rich and nourishing, but not a viscid, diet, he gave the lapis osteocolla night and morning with cinnamon; he afterwards daily anointed the arm with a

^f Observ. Chirurg. Centur. 1. Observ. 90 & 91.

^g Ibidem, Centur. 3. Observ. 90. pag. 275.

stimulating aromatic unguent, and then applied an emplaster of the same kind, with which some lapis osteocola was intermixed; and by these means in a few days time there was no grating of the bones to be heard, but the cure was compleated in the space of four weeks. Hildanus would willingly ascribe the success of the cure to the lapis osteocola: but in reality the rich diet excited the languishing powers, the stimulating ointment and aromatic plaister procured the juices to flow more effectually and powerfully into the affected parts, and by these means conspiring the cure was compleated. How much may be done towards restoring a defective nutrition in any part of the body, by such a slight or gentle irritation, has been already observed in the commentary on § 35. numb. 3. But when by weakness, or from the ill condition of the fracture, those powers are absent, which unite the divided parts, and regenerate the lost substance of the human body, in vain is the lapis osteocola administered, as is evident even from the testimony of Hildanus^s himself. For he candidly confesses, that he administered this stone, and applied it externally without success in a woman with child; and that after her delivery the cure happily succeeded. From hence I believe it is sufficiently apparent, that such remedies may be used without harm; but that the regeneration of the lost substance, and the reunion of the divided parts, as well in the bones as in the soft parts, is to be expected from the nature of the human body only, which is of itself sufficient.

S E C T. CCCXLVIII.

IF the fragments retain their proper situations, the first indication then ceases.

If they have receded but a little to either side, only a small extension is then required.

^s Observ. Chirurg. Centur. 5. Observat. 87. pag. 484.

But if the fragments are so displaced that they run up by the sides of each other, a large extension is then required in order to remove the intercepted parts, make a suitable reduction, and restore the whole to its due length.

Retain their situations, *etc.*] It sometimes happens, especially in the winter-time, when all bodies are more rigid and brittle, that a bone is so fractured by a fall or other accident, that the fragments remain in their natural situations; and such a fracture is known chiefly from the preceding cause being sufficiently violent, the pain deep, and a grating or crackling of the bones sensible to the ear or hand, when each part of the limb is agitated by the two hands. If then no alteration can be observed in the figure of the part, upon comparing it with the like part that is sound, (though the situation of the parts may be changed by turning them round, while the fragments remain contiguous) it is very evident that no extension nor reduction is then required, only the fragments are to be retained in that situation in order to a cure.

If they recede but a little, *etc.*] A bone is often broke so, that the fragments support each other, and yet form a protuberance on each side, or though the fragments remain in contact with each other on all sides, yet the bones may be so twisted, or drawn sideways, as to change the situation and direction of the parts inserted into the bones, which will appear from the deformity or injured figure of the limb. No violent extension is required in these cases, only such will be sufficient, as is capable of setting the bones at liberty from touching each other, that they may be reduced to their proper places without any grating of the fragments or ends of the bones.

By the sides of each other, *etc.*] For then the limb is contracted in its length in proportion as the fragments ride more or less over each other; and therefore

therefore such an extension is here required before the reduction can be made, as will draw the parts a little beyond their natural length, that the fragments may be replaced without rubbing against each other, and without intercepting any of the adjacent parts. Whence Celsus^a observes, after describing the signs by which such a fracture may be known; *Ergo, si hoc deprensus est, protinus id membrum oportet extendere. Nam nervi musculique, intenti per ossa, contrahuntur: neque in suum locum veniunt, nisi illos per vim aliquis intendit*; “Therefore when this sort of fracture is discovered, the limb must be immediately extended: for the nerves and muscles, which are kept extended by the bones, are then contracted; nor will they recover their situation, unless they are extended by some force.” And afterwards he adds, *Ubi vero paulo longius, quam naturaliter esse solet, membrum vis fecit, tunc demum ossa manibus in suam sedem compellenda sunt, etc.* “But when the extending force has made the limb a little longer than it naturally used to be, then it is that the bones must be pressed into their proper places by the hands,” etc. Nor is it easy to make too great an extension, especially in fractures of the larger bones; and therefore Hippocrates^b, in treating of a fracture of the thigh bone, orders a strong extension to be made; and adds, that the limb will not be injured, though the extension be made larger than necessary. And in another place he observes^c, that most make their extension less than they ought; but that he had seen too violent an extension made on a child. For in the younger age all the parts are softer, and a violent extension may there force the parts a good deal beyond their natural length, which is not much to be feared in adults, especially in fractures of the larger bones; for the strong muscles and tendons in them sufficiently guard

^a A. Corn. Celsi Medicin. Lib. VIII. cap. 10. pag. 532.

^b De fracturis, Textu 68. Charter. Tom. XII. pag. 222.

^c Textu 19. ibid. pag. 167.

against too great a distraction of the parts. Add to this, that a skilful surgeon may discover when the extension is made sufficiently, or whether it is required to be stronger, by feeling the fractured parts with his hands. In fractures of this kind therefore all surgeons order a forcible extension; and Parey^d strongly invited the surgeon not to spare him when his broken leg was to be set; desiring of him at that time to forget that he was curing a friend. But how violent an extension is sometimes required in difficult cases, may appear from the following history. A young man broke the tibia and fibula of his right leg near the ankle in such a manner, that the bones forced their extremities for near two inches through the integuments: and in this condition the unfortunate patient lay for seven hours before the surgeons could attend, whence the limb was by that time very much shortened, and a considerable tumour formed in the circumjacent parts. This fracture was also attended with a considerable wound, and the celebrated surgeon chiefly concerned owns, that the extension was made so forcibly in order to replace the fragments, that his assisting surgeon often cautioned him not to let the foot be pulled off^e. But in what manner the extension of a broken limb may be conveniently made, and with what precautions, is taught in the following aphorism.

S E C T. CCCXLIX.

THE extension is performed, 1. by taking firm hold of the bone near the fracture, either with the hands or with slings; 2. by firmly securing the patient; 3. by placing the part in its natural posture; 4. by a slow distraction of the

^d Livre XV. Chapit. 23. pag. 314.

^e De la Motte Traité complet de Chirurgie, Tom. IV. pag. 293,

fractured parts from each other, in a right line, with such a force as is sufficient to overcome the contractile power of the muscles; 5. or lastly, by the power and application of mechanical instruments, if the strength of the hands fail.

1. If nothing forbids, the injured limb is to be taken hold of by the hands near the place of the fracture; but sometimes a wound, violent contusion, or a distortion of the muscles, surprisngly altering the figure of the part, forbid the application of any force to the circumjacent parts of the fracture. But since the surgeon, who reduces the fragments, cannot at the same time make the extension of the limb himself, except in the lesser bones, as of the fingers, &c. it is therefore necessary to have assistants, who may make the extension at the same time that he replaces the fragments into their proper situations. Therefore the most skilful surgeons, especially in the more dangerous cases, call in the assistance of other surgeons, who, understanding the method of extension, know how to perform it as equally as possible, which conduces a great deal towards a happy restitution of the fragments. But as the part is often required to be kept a considerable time extended, before the fractured bones can be duly replaced, therefore those who make the extension ought to be placed so, that they may continue in the same posture for a considerable time without uneasiness, or else the operation might be interrupted. The best method of extension is by the hands, because that way the direction is sooner changed and more easily perceived, when it deviates from a right line; but if the thickness of the limb is such as prevents the hands taking firm hold of it on each side, as in a fracture of the thigh-bone; then it is advisable to extend the part by slings fastened on each side. Hence Celsus^a observes, *Intendant autem digi-*

^a Lib. VIII. cap. 10. pag. 532.

tum vel aliud quodque membrum, si adhuc tenerum est, etiam unus homo potest, cum alteram partem dextra, alteram sinistra prehendit. Valentius membrum duobus eget, qui in diversa contendant. Si firmiores nervi sunt ut in viris robustis, maximeque in eorum femoribus et cruribus evenit, habenis quoque vel lineis fasciis utrinque capita articularum deliganda, et per plures et in diversa ducenda sunt; “ But to extend a finger, or any
 “ other limb that is slender, one man may be sufficient, if he takes hold of one side with his right
 “ hand, and of the other with his left. A stronger
 “ limb requires two people, who may pull in opposite
 “ site directions. If the tendons or ligaments are
 “ very strong, as in robust men, and especially if
 “ the fracture happens in their thighs or legs, then
 “ slings or linen bandages are to be tied round the
 “ two heads of the bone at its articulations, and to
 “ be pulled by several people in opposite directions.”

2. The reduction of a fractured bone ought never to be attempted, unless the patient is retained immoveable either by ligatures or proper assistants. We ought not in this case to trust to the strength and courage of the patient, since the pain is frequently so severe while the fractured limb is extended, that it may oblige even the strongest man to resist and disturb the operation against his will.

3. That is said to be the natural posture of the part, which it acquires when a man is at rest, or rather in a sleep; for then all voluntary motions cease, and the parts of their own accord fall into their natural and most easy posture. The joints are never then extended, nor yet inflected but in a small degree. Now while the parts are in this natural posture, all the muscles are then the least extended; but if the part is altered from that posture, even against the inclination of the will, then those muscles will swell, which were destined to change the posture of the limb in the same manner by the will. Thus, for example, the strong deltoide muscle elevates the arm;
 but

but if the arm be lifted up by any other person, the same muscle will appear manifestly to swell, though not to so great a degree, as if the arm was raised by the influence of the will. But when a broken limb is extended in order to replace the bones, the muscles must be elongated, which may be done with a much less force when they are flaccid, than when they are swelled or turgid. Besides, if the limb is extended while it does not retain the natural posture, it will require to be restored to its natural posture after the bones have been replaced, because it cannot continue long in any other position without pain; but in doing this the situation of the parts will be altered, and the fragments will often be forced again out of their places. This is intended by Hippocrates^b, when he says, *Ex quiescente vero ac remissa rectitudines (ἰσομορφία) spectandæ sunt velut in manu*; “You are to observe that the limbs remain not straight but a little inflected, like the hand when it is not in action.” And Galen in his commentary to this text says, *Quibus in figuris, quum otiamur, partes habere consuevimus, hæc in curationibus eligendæ sunt*; “That we are to chuse that posture of the parts in the cure, in which we usually place the limbs when we are at rest.” And a little after describing the natural posture of the hands for example, he adds, *Itaque, si homines otuari consideraveris, plerumque manus inter summam extensionem & extremam flexionem non plane medias reperies, sed quæ ad extensionem propendeant*: “If therefore we consider the posture of the parts in men at rest, you will not find that the hands or arms retain a just medium betwixt flexion and extension, but that they incline a little from extension.” But Hippocrates himself says in the beginning of his book on fractures^c, (having first observed, that the extension both in fractures and luxations ought to be made as nearly as possible in a right line :) *plerumque nihil peccare illos, qui nihil prævio*

^b De Medici officina, Textu 21. Charter. Tom. XII. pag. 87, 88.

^c Charter. Tom. XII. pag. 153, &c.

consilio faciunt, ipse enim deligandus manum porrigit, ita coactus à justa natura, solos autem illos peccare, qui sibi plus sapere videntur; “ Those generally run into error, who do nothing with previous advice, for such a person extends the hand to be bound up, being so directed by unerring nature; but those only offend, who think themselves wiser than nature.” He afterwards in a very ample manner, disapproves of their opinion, who bind up the hand and fore-arm in a prone posture; and he blames them still more, who prefer a deligation of those parts in a supine posture, which is much more inconvenient than the former. He then well observes, that while some bind up those parts extended, they often excite pains and other accidents worse than the injury itself; and when they order the patient to bend the joints afterwards, neither the bones, tendons, nor muscles are any longer retained in their proper situations, but the resistance of the bandage being overcome, they are removed out of their places. And in another place^d, treating of a fracture in the arm, he says, *Si autem quis brachium extendens in illa positura deliget, brachii musculus tensus alligabitur, postea autem, ubi sic deligatus cubitum flexerit, musculus brachii aliam posituram habebit*; “ But if any one extends the arm, and binds it up in the same posture, the muscles of the arm will be bound together in a state of tension; but when the patient, who has been thus treated, endeavours afterwards to bend his elbow, the muscles of the arm will acquire a posture different from their natural one.” It is therefore evident, how important this rule is in the cure of fractures. Thus, for example, the natural posture of the os humeri is parallel to the trunk of the body, when none of its muscles are in action; and therefore in a fracture of that bone, the limb ought to be retained in that posture during the extension. If the bones of the cubitus should be fractured,

^d Charter. Tom. XII. pag. 88.

the limb should be a little inflected at the elbow, and the hand retained in a position betwixt prone and supination. The like is also true of the other limbs.

4. Hastiness is always prejudicial here; since it is required to restore the displaced fragments of the bone to their proper situations without offering further injury to the adjacent soft parts within their contacts. But unless the extension be made in a right line, the fragment will offer a greater injury to the adjacent parts. But this extension ought to be made slowly or gradually, because the contracted muscles, which are often contorted or displaced at the same time, cannot be violently elongated all on a sudden without danger of throwing them into convulsions. Therefore the extension of the fractured limb ought to be very gradually and equably increased; by which means the contracted parts may be the most safely elongated. Hence Hippocrates^e directs, in setting a fracture of the humerus, to suspend almost the whole weight of the patient, by placing a board or some other support under the arm-pit; or at least to fix it so that it will not give way, and then the cubitus being bent so as to form a right angle with the os humeri, is to have a soft strap fastened round it, to which a heavy weight must be appended, in order to make a moderate extension of the limb: he afterwards adds, that a strong man may supply the place of the weight, by pulling the affected parts downwards. But it is very evident that a man, in pulling or extending the limb, ought as much as possible to imitate the equable force of the weight, which, being appended, elongates the parts. But the bounds of the extension is limited to the elongation of the limb a little beyond its natural length, as we observed before from Celsus, under the preceding aphorism; for then the fragments may be replaced without any grating against each other, and without intercepting any of the soft parts adjacent. Nor is it easy to offend by making the extension too

^e De Fractur. Textu 3. Charter. Tom. XII. pag. 189.

great, especially in fractures of the larger bones, as in the femur, for example, which Hippocrates has well observed. But a greater or less extension will be required according as the muscles inserted into the fractured bones are stronger, by the contraction of which the limb is shortened. Whence Celsus^f says of these fractures in the thigh bones; *Neque tamen ignorari oportet, si femur fractum est, fieri brevius, quia nunquam in antiquum statum revertitur: summissque digitis postea cruris ejus infisti: ex quo multa debilitas est; fœdior tamen, ubi fortunæ negligentia quoque accessit.*

“ Nor ought the surgeon to be ignorant, that if the
 “ thigh is fractured, it will be shorter, because it can
 “ never be restored to its first state; and the leg of
 “ that thigh will afterwards tread upon the ends of
 “ the toes, which must be attended with much weak-
 “ ness; but with more deformity, when negligence
 “ also heightens the misfortune.” Yet it is possible
 that a too violent extension may injure the action of the limb by over straining the muscles, which may cause a weakness in them, as we proved in the comment on § 25. numb. 3. But when a skilful surgeon places his fingers upon the fractured parts, while the extension is making, he can easily perceive when it is carried to a sufficient degree, or whether it is required to be yet stronger.

5. The strength of the hands is often insufficient to make an extension of the femur, when fractured in adult and strong men; whence machines have in all ages been used for this purpose. Hippocrates^g himself describes several machines for reducing the bones of the legs and thighs, when the hands are not sufficient; and yet he observes, that it is a piece of vain ostentation to use machines when the business can be done without. Several such machines are figured in the works of Parey, Fabricius ab Aquapendente, and in the Memoirs of the Royal Academy of Sciences, in

^f A. Corn. Celsi Medic. lib. VIII. cap. 10. pag. 537.

^g De Fractur. Charter. Tom. XII. pag. 209, 213.

almost all which machines the parts held firm are elongated at discretion by turning round screws. In using these it is necessary to make the extension not by starts but equably, and in such a direction that they may act in a right line.

S E C T. CCCL.

ALL which (348, 349.) being often impracticable without pain and violence, when the parts are already inflamed, ought therefore frequently to be omitted until the inflammation is abated: otherwise the patient may die convulsed, or invaded with a gangrene.

If the bones have been a long time fractured, a large tumour is usually formed, which is often attended with acute pain and violent inflammation; but every extension of a broken limb, whether by the hands or machines, requires a pretty strong force, and a rough handling of the affected parts. It would be therefore a piece of cruelty thus to harass the parts already much inflamed and in pain; since the severity of the pain will endanger violent convulsions, or we may have reason to expect a gangrene from the rough handling of the inflamed parts. Hence Celsus^a prudently advises, after having said that the fractured limb ought to be extended: *Rursus, si primis diebus id omissum est, inflammatio oritur, sub qua et difficile et periculose vis nervis adhibetur, nam distentionem nervorum vel cancer sequitur, vel certe, cum mitissime agitur, pus. Itaque, si ante ossa reposita non sunt, post eam reponenda sunt.* “ Again, if the extension has been neglected for the first two or three

“ days, an inflammation arises, by reason of which it

“ will be both difficult and dangerous to apply any

“ distending force to the tendons and ligaments; for

^a Lib. VIII. cap. 10. pag. 532.

“ convulsions or a gangrene follow, or at least a sup-
 “ puration, when the whole is done as gently as pos-
 “ sible: if therefore the bones are not replaced before
 “ the inflammation is formed, they ought to be re-
 “ placed after the inflammation is gone off.” And
 Hippocrates^b speaking on the reduction of fractured
 bones which perforate the skin, likewise cautions that
 the parts ought not to be molested when there is an
 inflammation; and therefore, says he, the extension
 or reduction may be attempted on the same or on the
 next day: but by no means on the third, fourth, or
 fifth day; for then there is more danger of convul-
 sions from replacing the bones than from leaving them
 untouched. He likewise adds, that there are but small
 hopes of success, if convulsions follow the reduction
 of the bones; and says it would then be better to
 displace the bones again, if it can be done without
 much difficulty. And then he directs to wait till se-
 ven or more days are expired, after which the reduc-
 tion may be attempted, if the fever and inflammation
 are gone off. In another place of the same book^c,
 in treating of those fractures, in which the bone of
 the femur, or humerus is shattered, he observes that
 then the nerves, blood vessels, and muscles are lacerat-
 ed; and that if the fragments are replaced, convul-
 sions usually follow; whereas those more frequently
 escape, in which no reduction of those bones has been
 attempted.

When therefore the violent laceration of the adja-
 cent parts, or the too great length of time which has
 passed before proper assistance could be had, has oc-
 casioned the parts to be invaded with great tumour,
 pain, and violent inflammation; we are then certain
 that a rough handling will be in danger of causing
 convulsions, or a gangrene. It is therefore necessary
 to remove those symptoms before a reduction of the
 bones can be safely attempted; or at least it is requir-

^b De Fracturis. Charter. Tom. XII. pag. 252, 253.

^c Ibid. pag. 257.

ed to abate them as much as possible. Here then, plentiful bleeding, the application of emollient cataplasms and fomentations to the injured parts, with internal antiphlogistic remedies, and a plentiful use of diacodium, are the most common and effectual remedies to diminish the pain and inflammation, and to cause the tumour of the parts to subside. These means are to be repeated according to particular circumstances, till their effects answer the intention of the physician; and then, but not before, a restitution of the fragments may be attempted. But if notwithstanding the use of these means the symptoms remain equally violent, or are increased, prudence then requires to proceed no further, and if a mortification is feared, the amputation of the limb then only remains; otherwise the fractured bones are to be let alone, and the whole business committed to nature. Hence it is that Hippocrates (as we observed in the comment to § 343.) advises physicians not to meddle with these cases, when they can avoid them without reflections: for if the fractured bones are not replaced, the physician will appear defective in his art; and if they are replaced, the patient is nearer his death than recovery.

Although fractured bones ought to be replaced as soon as they possibly can, yet a reduction of them is not to be despaired of even several days after the accident. Hippocrates^d, treating of a fracture in the bones of the cubitus, having first described the method of binding up the fractured limb, says; that by the seventh day the fractured part becomes so slender, the whole tumour disappearing, that the fractured bones may be then very easily reduced to their proper places, if they have receded from thence, or were not rightly adapted in the beginning. Hence it appears, that fractured bones may be replaced and conjoined together, after so long an interval of time.

^d De Fracturis Text. XLI. Charter. Tom. XII. pag. 178.

S E C T. CCCLI.

IF the fragments are loose, they are to be taken out, when that can be easily performed. If any protuberant splinters or sharp points of the bone plainly hinder the extension, if they are within sight, they must be cut off; or if they lie concealed, they must be first exposed by incision. If the fracture is compound, and much complicated, and especially if attended with a violent contusion, splintering of the bones, or a destruction of the larger vessels, it requires an immediate amputation of the limb, if nothing forbids.

The fragments and splinters of the bones create much trouble and difficulty in the cure of fractures, especially when their sharp points injure the adjacent soft parts. This too frequently happens, when the tibia, and fibula are broke at the same time; and it is very evident, that even the worst consequences may from thence arise, if those fragments irritate the tendons and muscles while the limb is extending. It is therefore a just conclusion that these fragments ought to be removed, especially if they are free on all sides from any cohesion; for then they impede the cure like any foreign body. Yet the surgeon ought always to examine first, whether the fragments may be extracted without much difficulty, or without offering any great injury or irritation to the adjacent parts: otherwise they ought rather to be left to themselves, since they will be afterwards separated and cast out spontaneously. Celsus^a, in treating on this subject, says: *Si id majus est, membranulisque cingitur, sinere oportet has sub medicamentis resolvi.* “If the fragment
“ is large and covered with membranes, it is best to

a Lib. VIII. cap. 10. pag. 540.

“ let it loosen under those membranes by the use of
 “ medicines.” But Hippocrates^b observes, that those
 medicines cause these fragments to separate the most
 speedily, *Quibus celerrimæ suppurationes fiunt, et qui-
 bus celerrime ac optime caro increfcit: etenim incref-
 centes carnes in parte vitiata ut plurimum offa attollunt.*
 “ Which the soonest cause a suppuration, and which
 “ the best and most speedily procure an incarnation:
 “ for the flesh growing up in disordered parts gene-
 “ rally raises up the bones.” And in another place^c,
 treating of that case where there is some part unex-
 pectedly cast off from the bone, he says: *Signum esse
 ossis abscissuri, si pus copiosius ex ulcere profluat, et
 quasi ad exitum festinet* (ἢ ὀργῶν φαίνεται) “ It is a
 “ sign that some part of the bone is about to be cast
 “ off, if the matter is copiously discharged from the
 “ wound, and runs hastily in a manner to its orifice
 “ or opening.” Parey^d predicted in himself that
 some part of the bone would be cast off when he ob-
 served the lips of the wound swell, discharge a thin
 and crude ichor, and the circumjacent flesh appear
 soft like a sponge. But what considerable fragments
 are sometimes thus cast off by the assistance of nature
 only, is evident from the instance alledged in the com-
 mentary on § 343.

If any protuberant splinters or sharp points, *etc.*] Sometimes it happens that the extremities of the fractured bones are sharp pointed, which is by Celsus^e deservedly pronounced to be one of the worst species of fractures, because they cannot be easily retained in their situations after they have been reduced, and because they wound the adjacent parts. If then the extension of the limb is prohibited by these sharp points of the bones, nothing more remains than to cut them off if they stick out. Celsus^f, in treating on this subject, says: *Si acutum, ante acumen ejus, si*

^b De Fracturis, Charter. Tom. XII. pag. 254.

^d Livre XV. Chapit. 25. pag. 346.

cap. 7. pag. 524.

^e Ibid. pag.

^e Lib. VIII.

^f Ibid. cap. 10. pag. 539.

longius est, præcidendum; si brevius, limandum, et utrumque scalpro lævandum: tum ipsum recondendum est, etc. “ If the sharp point sticking out from the edge

“ of the bone is long, it should be cut off; but if
 “ short, it is to be rasped or filed away, and both
 “ the points and edges are to be reduced to an even
 “ surface by a scalprum: and after this the bone itself
 “ is to be replaced,” &c. Hippocrates^s observes,

that the eminences of fractured bones are to be cut off if they are offensive, appear naked and troublesome, or wound the fleshy parts; and then he says: *Reliqua vero non multum refert, præcidantur necne: scire enim certo licet, ossa, quæ ex toto carne nudata sunt, et arida, omne penitus abscessura: a quibus autem squama separabitur, illa præcidere non oportet, etc.*

“ But as for the rest of the fragments, it matters not
 “ much whether they are cut off or not; for you
 “ may be very well assured that the bony parts
 “ which have been laid quite bare of their flesh, and
 “ become dry, will all entirely exfoliate or be cast
 “ off: but one ought not to cut off a part of the
 “ bone which will separate or scale,” &c. And even

though it may seem cruel, yet it will be necessary to cut through the whole integuments, and remove these fragments when they wound the adjacent parts, or prevent the due extension of the broken limb. The

common people usually believe, that surgeons, being hardened in their practice, are often regardless of the miseries of others, and sometimes use the knife and cautery where more gentle methods would succeed with equal safety, though more slowly. But as they themselves are subject to the like calamities and disorders, it is hardly credible that they should prefer a severer to a more gentle method, even upon themselves, if there were not important reasons to urge it. But Parey, having received a very bad fracture of the leg, advised the expert surgeon who attended him not to spare him as a friend, but to enlarge the

^s De Fracturis. Charter. Tom. XII. pag. 256.

wound by the knife, that the bones might be more commodiously replaced, and the splinters be extracted by his fingers, at least such as were found unattached to the adjacent parts ^h.

If the fracture is much compounded, &c.] If the laceration and destruction of the parts is so great, as to totally destroy the vital circulation of the humours through them, there are then no hopes left, but the whole will be in a little time corrupted: whence there only remains but one remedy in this case, namely, to extirpate the part thus affected; provided there is reason to hope that it may be performed without destroying the patient's life. For as the separation of the corrupted parts and the union of those which have been divided, depend on the circulation of healthy juices, through sound vessels; therefore if any of the larger vessels are injured, or have their structure destroyed by a violent contusion, so as to abolish the motion of the humours through the injured parts, there can be then no hopes of success without extirpation. But it must be well remarked, that this last and dangerous remedy ought not to be put in practice till we are assured there is no life remaining in the part; for we are taught by surprizing instances, that life has sometimes returned into the parts when they have been adjudged to be perfectly dead; and therefore it is best to wait at least a day or two, and in the mean time to treat the injured parts well with such antiseptic fomentations as may preserve them from putrefaction, since we are provided with such remedies of this nature by art, in which we may confide, as was said before under the cure of contusions. But to shew that we ought not immediately to have recourse to extirpation in the worst kind of fractures, it will be sufficient to alledge the wonderful case which we mentioned in the commentary to § 343. A man had the tibia and fibula miserably fractured by the wheels of a carriage loaded with several thousand weight

^h Ambr. Paré Livre XV. Chapit. 23. pag. 334.

passing over his leg, which made such a violent contusion and laceration of the parts, that the whole limb might have been easily cut off with one cut or two of the scissars. The bones were quite laid bare of all their integuments, a profuse hæmorrhage much weakened the patient; and all the circumjacent parts being miserably contused, swelled greatly, insomuch that there was scarce any apparent hopes of preserving life in the parts thus egregiously injured. But after replacing the bones, a large suppuration followed, attended with a great tumour and a cadaverous smell, which denoted the worst consequences to be thence feared; and therefore it was not without reason that a very skilful surgeon, who was consulted, advised to amputate it. But the other surgeon, who had attended from the first of the accident, confiding in the patient's strength and good habit, with the favourable-ness of the season of the year, there being neither fever nor great pain, was bold enough to defer this severe and hazardous remedy, and by continually fomenting the injured parts with wine or its spirit, he prevented any putrefaction. After two month's time a large portion of the os tibiæ was separated and cast out, while the fragments of the fibula in the mean time united. The lost part of the tibia was repaired with good callus, so that in the space of a year the cure was compleated, and the limb perfectly recovered its use without any deformity, notwithstanding the enormous injury it had received.

S E C T. CCCLII.

THE restitution of the fragments to their proper places, is performed, by turning round the part so gently, slowly, and cautiously after it is duly extended (349,) and prepared (351,)

ⁱ *Traité complet de Chirurgie par M. de la Motte, Tom. IV. pag. 284, — 290.*

that the parts of the bone may correspond properly with each other, and then let the distorted muscles be replaced in their proper seats and all without intercepting any of the soft parts.

The surgeon who undertakes the cure, commits the extension of the fractured part to the other assisting surgeons, or to servants; but the replacing of the fragments while the part is duly extended, is his own proper business; since the neatness of the cure depends entirely thereupon. Hence Hippocrates^a observes, that the patient is to be so placed, that the affected part may be opposed to the light, that in its extension the operator may discern whether it continues nearly enough in a right line. If then the extension is so far continued, that the bones, which before rid over each other, can be reduced to their pristine situations without injuring the circumjacent parts, then the surgeon may direct and replace the fragments by the action of his hands and fingers upon the fractured parts. It must be here well remarked, that it is not sufficient to bring the bones together in contact, but it is necessary to place the fragments in the very same position which they had before the fracture: As for example, when the os humeri is fractured, the ends of the bone may be so adapted that the arm will remain twisted, and the situation and direction of all its muscles altered and disturbed, whence might follow a great deformity of the limb, with a depravity of the uses of the affected parts. Great caution is therefore necessary in this case, and the work must not be done too much in a hurry; for it will be much more difficult to correct afterwards an error that has been once committed. But when a due extension has been made, the muscles attached to the bones, usually reduce the fragments to their proper places by their contraction, so soon as the extension is

^a De Fracturis Textu 17. Charter. Tom. XII. pag. 166.

remitted; or if they should be embarrassed or twisted, the skilful surgeon may correct and help them, by gently turning and pressing on them with his hands.

It must also be remarked, that the extended part must not be let loose all of a sudden, and at once, but by degrees; for otherwise there would be danger of intercepting some of the adjacent parts betwixt the fragments of the bones, which would prevent their union, and excite pain, inflammation, and other bad symptoms, as is sufficiently evident.

S E C T. CCCLIII.

THAT the bones are thus properly reduced, the surgeon knows from the anatomy of the parts, by comparing the affected part with that which is sound, by the removal of the pains, and by the restitution of the part to its natural figure and length.

After it is judged that the fragments have recovered their proper situations, it must be carefully examined, before the bandages are applied, whether the reduction of the fragments is such, that the other adjacent parts also retain their natural situations; and then it is usual for the surgeon to ask the physician present to examine the whole. But that they are thus replaced is known,

From anatomy.] For it is from thence that we are acquainted with the situation and figure of the bones. And in such parts where the uncovered bones may be easily felt, one may easily discern whether the fragments deviate from their proper situations: As for example, by moving the fingers down the whole length of the spine of the *os tibix*. But it is not so easy to discover this in other parts, where the bones are covered with thick muscles.

By a comparison of the sound part.] This is a method of the last importance in order to determine certainly, whether the fragments are rightly replaced. For example, if the bones of the leg are fractured, after reducing them, the diseased leg is to be compared with the other which is sound, and a careful examination must be made, whether the same cavities, protuberances, &c. appear in each alike. For the bulk and position of the muscles it is that gives the shape of the limb; and if these appear altogether the same in the affected and in the sound limb, we may be certain that all the parts retain their proper situations. This is what Celsus^a seems to intend, when he says, that after the bones have been reduced to their proper places: (*At membrum alteri æquatum, involvendum duplicibus triplicibusve pannis, &c.*) “The limb appearing uniformly like the other, is to be rolled up with cloths two or three times doubled,” &c.

The removal of the pain.] When the fragments ride over each other, it is impossible but the adjacent parts must be pressed and distracted; and if the fragments are sharp pointed, they must necessarily prick and lacerate those parts; whence it is sufficiently evident from what cause such excruciating pains frequently arise in fractures. But so soon as the bones are reduced, the cause of this pain then ceases, and therefore the pain itself immediately goes off, or at least is much abated, (since a violent contusion or laceration of the parts may sometimes cause the pain to remain after the bones are well reduced:) and then we are assured, that no parts are intercepted betwixt the fragments if the pain ceases. Hence Celsus^b lays it down as a positive rule, *Indicium ossis repositi est dolor sublatus*; “That if the pain is removed it is a sign the bone is reduced.”

By a restitution of the part to its natural length and figure.] This may be known by comparing the

^a Lib. VIII. cap. X. pag. 532, 533.

^b Ibid. pag. 532.

part injured with that which is found: for if the fractured bones *non adversa, sed obliqua junguntur* (*quod fit, ubi loco suo non sunt*), *membrum id altero latere brevius est, & musculi ejus tument*; “are not
 “joined oppositely but obliquely, which happens
 “when they are displaced, the limb is then shorter than
 “that of the other side, and its muscles swell ^c.”

But great circumspection is required in comparing the fractured with the sound limb; since the most skilful have been sometimes deceived in this respect. A man broke his thigh-bone near the neck, whence the fracture was at first mistaken for a luxation. The fragments being replaced (as was imagined) in their natural situations, the surgeons compared the length of the injured limb with that which was found, and the injured was found shorter than the other: but as it could be pulled as long as the other sound limb without any violence, nothing amiss was suspected. Yet the patient halted after the cure, and the fractured limb was apparently shorter than the other. When they examined again and extended both the legs as the patient lay on the bed, they found that without difficulty the injured leg might be extended as long as the other; and they then found, that the os ilium of the affected side had descended in the first extension, and so gave the appearance of a false equality in the two limbs; since the flexibility of the loins easily permits the os ilium to descend with the extended thigh. Therefore when the surgeon examines whether the length of the injured leg is equal to that of the sound one, he ought to be certain that the ossa ilii on each side are placed in the same line of altitude ^d; for it is possible the patient may elevate or depress the os ilium of one side to avoid pain.

^c Lib. VIII. cap. X. pag. 532.
 Pan. 1722. Mem. pag. 450. 451.

^d Academ. des Sciences

S E C T. CCCLIV.

TH E retention of the bones in their situations is performed with bandages, compresses, and splints, by keeping the limb at rest in a box or case, and by preventing or directing the action of the muscles.

It is often much more difficult to retain the reduced fragments in their proper situations than is commonly imagined; and it is in this part of the cure of fractures, that the skill and dexterity, of the surgeon are principally apparent. For the muscles attached to the bones may by their contraction displace the fragments out of their natural situations; and the same accident may also arise from coughing, sneezing, moving the limb in sleeping, &c. which last is a circumstance lamented by Parey ^a, viz. that in his sleep the muscles being strongly contracted elevated his broken leg, whereby the fragments were immediately removed from their contacts, and made it necessary to replace them again by a new extension, not without extreme pain followed by an inflammation, fever, and suppuration. It is therefore necessary to so secure the injured limb, as that it may continue quite immovable. But this is effected,

By bandages.] Various bandages are applied to fractured limbs, according as the dressings are required to remain a longer or a shorter time upon the parts before they are renewed. In a simple fracture a spiral bandage with one or two heads is sufficient ^b. But when a wound, violent contusion, inflammation, &c. attends the fracture, it would be inconvenient to remove this apparatus every day to treat the affected parts with proper remedies; for the injured limb must

^a Livre XV. Chapit. 25. pag. 346.
Chirurg. Tab. 2. lit. b. c.

^b Heister. Institut.

be lifted up in order to take off and re-apply the spiral turns of the bandage: but this can scarcely be done without danger of displacing and separating the fragments from each other. Therefore another method has been contrived by surgeons, namely a foliated bandage with eighteen leaves or heads, as they are often called; being formed of three pieces of linen laid over each other, and cut into three parts by two slits on each side; but so however that the piece of linen next the limb is the shortest, the other a little longer, and the outermost the longest of them all. This foliated bandage being moistened with oxycrate, or some such liquor, is placed under the injured part, and then the two middle leaves or heads of the innermost piece of linen are first applied over the part crossing each other, and then the rest of the leaves crossed over each other successively in the same manner. So that it is necessary for the pieces of linen to be long enough to exceed a little the thickness of the limb to wrap over. But a better idea of this bandage may be had from figures than from any description alone, for which consult Heister^c, and others who have treated on bandages. But though this bandage is reckoned a modern invention, there seems to be one of the like make described in Hippocrates^d. For in cases where he expected any large fragment to separate or be cast out, he orders to take double cloths of the breadth of half a span, not less; but a little shorter in length than to go twice round the limb, and at least much longer than to go once round: and let these cloths be as many in number as the case may require. Having dipt these in black austere wine, he would have them applied to the middle of the affected part, in the manner usual for applying bandages with two heads; then proceed to cross the heads over each other, the right towards the left and the left towards the right; nor does he order them

^c Institut. Chirurg. Tab. IX. fig. 4. & Tab. XXXVIII. fig. 25. & pag. 1244.

^d De Fracturis Charter. Tom. XII. pag. 241, &c.

to be in the least tightened, but to be disposed so as that the wound may appear. Galen, in his explanation of this text of Hippocrates, gives almost the same description of this foliated bondage. And yet Celsus, in the cure of a fracture accompanied with a wound of the soft parts, makes no mention of any such bandage; but he only directs to make the deligation of the part more loosely than if it was not wounded; and rather to increase the number of bandages, that they may secure it equally though loosely^e. The great usefulness of this bandage consists in admitting the dressings to be renewed, in order to cure the wound without taking off the bandage.

But the necessary qualities of bandages in general are beautifully represented by Hippocrates^f, when he says, *Fasciæ parandæ sunt leves, tenues, molles, mundæ, latæ, nullas suturas, neque eminentias habentes, satis validæ ut extensionem ferant, pauloque fortiores, non aridæ, sed succo madentes, quo quæque inebriari consueverant*; “Bandages ought to be provided which are
 “light, thin, soft, clean, broad, and without any
 “seams or eminentias, of a sufficient strength, that
 “they may bear a little stronger force than that ap-
 “plied to extend them; nor are they to be used dry,
 “but moistened with some liquor, in which it is usual
 “to dip them.”

It is sufficiently evident, that the foliated bandage before described does not so firmly retain the parts as that which is made by spiral circumvolutions; and the wound, ulcer, or violent contusion, which accompanies the fracture, would not support so violent a compressure, and therefore the foliated bandage is in this case sufficient. The spiral bandages have principally this advantage, that they retain the replaced fragments^g in their situations by an equable pressure; and therefore it is that surgeons usually bind up the fractured part with a spiral bandage at first; and if,

^e A. Corn. Celsi Medic. Lib. VIII. cap. 10. pag. 539.

^f De

Medici officina Charter. Tom. XII. pag. 62.

for example, they carried this first bandage from the left to the right, they then began with another spiral bandage upon the part, and carry it from the right to the left, in order to make the more equable pressure, and to act principally upon the fractured part. All which is again beautifully described by Hippocrates ^g, who says, treating on the cure of fractures of the bones of the cubitus, *Postea oportet fascia deligare, principio supra fracturam injecto, sic ut firmet quidem, non tamen vehementer comprimat. Ubi bis vel ter sic fasciam superduxerit, ad superiora distribuatur, quo sanguinis affluxus intercipiatur, ibique desinat. At primas fascias minime longas esse oportet, secundarum vero initium supra fracturam injiciendum est, ut semel circa illam revolvatur, tum deorsum demittatur, lenius adstringatur, atque ex majori intervallo circumdetur, &c.* “ After
 “ this you must make your deligation with a bandage,
 “ fixing the end of it upon the fracture, so that it
 “ may hold fast, but not violently compress the parts.
 “ After two or three turns thus made with your bandage upon the fracture, carry it upwards, to prevent
 “ the too great afflux of blood, and there let it terminate. As for those bandages which are to be the
 “ first applied, they ought to be not so long, but the
 “ beginning of your second bandage is to be fastened
 “ upon the fracture and passed once round it, and then
 “ let it be carried downwards, tightening it gently,
 “ and making your circumvolutions at larger intervals, &c.” In the same place he has also several other useful admonitions concerning the use of bandages, as also in Celsus ^h.

Compresses.] It is an admonition of Hippocrates ⁱ, that *probe nosse oporteat, omnem fasciam ad declivia & acuminata diffugere, ut in capite sursum, in tibia deorsum,* “ It ought to be well observed, that upon such
 “ parts as are acuminated, or have any declivity, all

^g De Fracturis Charter. Tom. XII. p. 169—173.

^h Lib.

VIII. cap 10. pag. 533.

ⁱ De Medici officina Charter. Tom. XII. pag. 48.

“ bandages loosen or fly off, as in the head upwards, “ and in the leg downwards.” And therefore in another place he says^k, *quæ extremitate tenuantur, spleniis æquanda sunt in orbem datis, &c.* “ Those “ parts which are tapering towards their extremities, “ are to be made even with compresses rolled up,” &c. Compresses have therefore this principal use, that being properly applied, they give the affected parts a cylindrical figure, that the bandages may hold the faster, and not slip off of their own accord towards a smaller end of the limb. Also when, for example, the end of the broken os femoris recedes outwards, in that case the pressure of the bandage may be so determined by the application of compresses, as to act more upon the receding part, and by that means prevent the fragments of the bone from being easily displaced again that way, by the action of the muscles, or of any other cause. But of what a considerable use compresses are in directing and preventing the action of the muscles we shall presently declare.

Splints.] Tho’ the injured part may be well secured by compress and bandage duly applied, yet they will not prevent the limb from bending in the part fractured, if it should be moved in sleep, or by some accident; whence the situation of the replaced fragments would be disturbed. For this reason surgeons fix splints, of thin wood or thick pasteboard (board paper) round the limb, to prevent this accident. These splints are required to be firm enough to hinder the bending of the limb in the fractured part; being such as may be easily adapted to the figure of the injured part, and are at the same time so light, that they prove no incumbrance by their weight. But because the hollow stalks of the plant ferula, being very light, and yet strong, induced the ancients to use them for this purpose, it is from thence that this part of the apparatus for the cure of fractures, has acquired the name of ferulæ or splints.

^k De Fracturis Textu, 34. Charter. Tom. XII. pag. 173.

Hippocrates¹ treating of them, says: *Ferulae autem sint leves, æquales, in extremis simæ, hinc & illinc parum minores deligatione; crassissimæ autem, qua exstat fractura.* “But let your splints be light, and of the same size, with obtuse or rounding ends; being a little thinner in those parts where they are to be tied on, but thickest where they cover the fracture.” The splints are fastened on by slight ligatures only, because they are not applied to press, but only to defend the bandage, as Hippocrates prudently observes in another place^m; where he also adds, that care must be taken not to injure the prominent parts, which are not defended with flesh, by the application of the splints; for from thence might follow an ulcer, and the tendons might be laid bare. Hence he orders, in a fracture of the cubitus, not to place the splints by the side of the thumb or little finger, or if it is necessary to apply them so, let them be very short; for otherwise the prominent ends of the radius and ulna near the wrist would be injured. The same is true likewise in a fracture of the leg: namely, care must be taken not to let the splints touch the ancles, nor the protuberant parts of the tibia and fibula at the knee: for the whole pressure of the ligatures retaining the splints in their places, would be returned upon those parts only. I have seen an error of bad consequence, when the surgeon has neglected this caution; for a gangrene was produced at the ancles and knee, barely by the pressure of the splints upon those parts. But it is evident from what has been said before, that if only one bone is broke in those parts which have two, that then splints are not always so very necessary to be used. This is well observed by Celsusⁿ, who says almost the same with Hippocrates concerning splints. *Curiosius omnia in continendis ossibus fiant, si neutrum alteri auxilio est.* Nam,

¹ De Medici officina, pag. 79. Charter. Tom. XII. ^m De Fracturis Textu 14. Charter. Tom. XII. pag. 179. & de Medic. officina ibid. pag. 8c. ⁿ Lib. VIII. cap. 10. pag. 536.

ubi alterum integrum est, plus opis in eo, quam in fasciis ferulisque est. “ Every thing must be conducted
 “ with greater care and exactness for retaining the
 “ bones, when one affords no support to the other :
 “ But when one of them remains whole, it will of
 “ itself be of more service than even bandages and
 “ splints.” From the places before cited from Hippocrates and Celsus, it appears that they did not apply the splints before the seventh day : but the modern surgeons apply them at the first dressing, which Parey ° took care to have put in practice upon himself.

Box or case.] It is also further required to retain the injured limb so securely that it may remain immoveable, and as easy as possible ; and as it is necessary for the limb to continue thus always in the same posture, therefore the injured parts are to be so disposed, that they may continue a long time at rest with the least uneasiness. Thus, for example, in a fracture of the leg or thigh, the articulation of the knee ought to be a little inflected ; for no body can lie a long time with their leg extended. In the next place, the limb is to be so supported by pillows, that its weight may be sustained by the whole length and lower surface of the limb, and not by one or two parts only ; for that might occasion an inflammation and a gangrene of the parts too much press'd. Thus a gangrene of the worst kind has been sometimes observed to invade the heel from this cause only. And Hippocrates ^p observes, that by a too long lying of the limb upon the heel, the os calcis itself becomes at length corrupted, and is a case that may be attended with the greatest danger ; because when this bone is corrupted, the disorder may continue as long as the patient lives. To avoid this accident Hippocrates ^q advises in another place, to fix the broken leg after it is bound up upon a soft plane, so that it

° Livre XV. Chapitre 23. pag. 344.
 ter. Tom. XII. pag. 200, 201.

^p De Fracturis Char-

^q Ibid. pag. 217.

may neither incline to one side nor the other, nor rise higher before than behind, nor be apt to turn easily any way. For if the limb is not sustained by its whole length, but presses only upon the heel and knee, an incurvation may follow in the fractured part, from the weight of the other parts. The same incurvation may also follow, if the fractured part is sustained, but the foot and heel are permitted to descend lower than the rest of the leg. But as for the cases used to retain broken legs from moving any way, Hippocrates^r confesses that he knows not what to say of them. They may indeed be of some use, but not so serviceable as is commonly imagined: for if the body is turned to either side, the case will not hinder the leg from following, if the patient himself is not cautious to prevent it; nor will it prevent the leg from being moved even without any motion of the body. But he adds, that the operator will be less liable to blame from the vulgar, if he uses one of these cases. But the modern surgeons have contrived very beautiful machines for the commodious placing and retaining a fractured limb from being moved; and which at the same time easily permit the dressings to be renewed in complicated fractures. Such a case for the retention of a broken leg, is described in the Mem. Acad. Reg. Scient.^r, and the figure and description of it may be also seen in (tab. ix. lib. II. cap. 10. § 2.) the surgery of the celebrated Heister. A commodious disposition of the injured limb, and of the rest of the body is evidently of the greatest importance towards a cure in fractures, where the patient is obliged to lie so long a time; and therefore the most skilful surgeons themselves stoop to lay the patient's bed as it ought to be^t, that they be assured all is right.

^r De Fracturis Charter. Tom. XII. pag. 217. ^s l'an 1718. Mem. pag. 396. ^t Traité complet de Chirurgie, par M. de la Motte, Tom. IV. pag. 179.

By preventing and directing the action of the muscles.] In this the skill of the surgeon is principally apparent: for when the bones are fractured, the direction of the muscles attached to them is disturbed, if not prevented by art, and by contracting they will displace the fragments. Thus for example, if the radius is fractured, the pronator quadratus, and the ligament betwixt the radius and ulna will contract the fragments of the former towards the latter; and this injury will be still augmented by the pressure of any bandage. But if compresses are placed betwixt the radius and the ulna, this will occasion the pressure of the bandage to be returned chiefly upon the compresses, and they may prevent the radius from approaching towards the ulna. The same may also take place in a fracture of the fibula. But when the bone is fractured into several pieces, there is danger lest the contraction of the muscles should thrust out the fragments, by which means the limb might afterwards become shorter: and therefore, in such a case, it will be necessary to preserve the due length of the injured part by the application of machines that prevent contraction, till the uniting of the fragments and strength of the muscles prove sufficient for the resistance. But of this we treated in the commentary on § 346. That there is often no small difficulty in the deligation of these fractures has been well observed by Hippocrates ^v, who in treating of a fracture of the heel, says, that it is not every one who is able to make a proper deligation in those cases; for if the common bandage of the ankle is applied, by passing the roller about the foot and tendon achilles, the pressure of the bandage would again displace the calcaneum. And then he proceeds to describe the best method of deligation in the same case; from whence it is evident how extremely necessary it is to have a knowledge from anatomy of the adjacent tendons and muscles, in the cure of fractures.

^v De Fracturis Charter. Tom. XII. pag. 199.

S E C T. CCCLV.

TOO tight bandages intercept the circulation, so as to produce a tumour and a gangrene; from whence follow infinite disorders: they ought therefore to be gently tightened, so as to hold firm, and but moderately press upon the small vessels.

Great injuries often arise from too strict bandages, made with a design to retain the replaced bones. For it commonly happens that the fractured limb begins to swell within a few hours time; and especially about the part of the fracture; whether the tumour be a consequence of the fracture, contusion, or the rough treatment of the part, in order to replace the bones, and make a due extension: so that if the bandage was too tight at first, before this tumour appeared, it is evident that as the tumour arises the pressure of the bandage will increase; whence follow an obstruction of the compressed vessels, an inflammation, or even a total stoppage of the circulation and a gangrene. Intense pains often arise from the too great stricture of bandages; but if the surgeon neglects the patient's complaint, he often finds his error in a gangrene of the part, which being corrupted, can be only remedied by extirpation. Hence all skilful surgeons carefully admonish to enquire into the cause of the patient's pain when he complains, and rather to remove all the dressings, than to suffer a destruction of the affected part, or even hazard the patient's life. The bad events of such a neglect have been frequently observed, and several instances are related by the celebrated le Motte^a. It will be, therefore, the least hurtful of the two to make the bandage over slack than too tight, because the former may be corrected

^a *Traité complet de Chirurgie*, Tom. IV. pag. 272. &c.

by the application of a second bandage. But the signs by which one may know whether there is a sufficient stricture made by the bandages, are very well enumerated by Hippocrates ^b, where he says, *Signa autem recte curati hæc sunt, & terminus deligandi. Si rogaveris, an prematur, & dixerit, se premi quidem sed leviter, & maxime circa fracturam. Moderationis autem indicia sunt, si illa die, qua deligatus fuit ac nocte, ipse sibi videatur non levius, sed valentius adstringi, post die autem parvus tumor (οἰδηματίου) in manu oriatur & mollis. Signum enim hoc tibi erit moderatæ adstrictionis. Labente jam die minus adstrictas fascias sentiat, sed tertio die laxas omnino. Scire autem licet, si quid ex dictis absit, quod justo laxior sit deligatio, si quid ex dictis superet, plus justo fuisse adstrictam.* “ But the “ signs which denote that the fracture hath been “ rightly treated, and the deligation duly made, are, “ if upon enquiry the patient affirms, that he feels a “ stricture, tho’ but a gentle one, and especially a- “ bout the part fractured. And it is a sign the ban- “ dage is not too tight, if within the first day and “ night after the dressing, the patient feels the stric- “ ture not diminished, but rather increased, and the “ day after a slight and soft or œdematous swelling “ appears in the hand or lower part. The second “ day being elapsed, the patient feels the stricture “ of the bandage diminished, and on the third day “ it seems to be quite loose. But you may observe, “ if any of the forementioned appearances are ab- “ sent, that then the deligation is looser than it ought “ to be, or if they exceed beyond this description, “ then the bandage has been applied too tight.” If that tumour which invades the inferior part of the limb below the bandage appears small, soft, and white, it denotes that the veins are but slightly compressed, from whence, with the inactivity of the part not forwarding the blood thro’ the veins, it is

^a De Fracturis Textu 37. Charter. Tom. XII. pag. 175; &c. & de Medici Officina ibid. pag. 95.

that the tumour itself arises; but when the parts are swelled above the bandage, it is a sign that the arteries are likewise compressed, which may produce an inflammation or a gangrene. But when on the third day the bandage appears spontaneously relaxed, by the diminution of the swelling in the parts, Hippocrates^c then orders the bandages to be drawn a little tighter, and to repeat the stricture likewise on the seventh day, if it shall be found necessary; always observing the cautions before given. But when the dressings are removed, it ought always to be carefully examined whether any of the fragments have receded from their natural situations, as we said before at § 353.

S E C T. CCCLVI.

IF there are any wounds accompany the fracture, they are to be treated according to the rules of art, as mentioned from § 185 to 239, but they seldom admit of deligation. The same is also to be understood of an inflammation, pain, tumour, and other symptoms attending.

If so considerable a wound attends a complicated fracture, that it cannot be safely left to nature; then the foliated bandage, with eighteen heads or leaves, ought to be used, that the wound may be commodiously treated without danger of separating the fragments. 'Tis true, this bandage does not so firmly retain the part as that made by spiral circumvolutions; but in this case the wound will not permit a greater stricture. 'Tis an ill practice of some to compress the circumjacent parts by a spiral bandage, leaving the place of the wound open, or else by cutting out a piece of the bandage, to leave an opening over the wound: for when the circumjacent parts are com-

^c De Fracturis Textu 40. Charter. Tom. XII. pag. 177. &c.
pressed,

pressed, and the wound left open, the humours are derived more forcibly and copiously to the wounded part; whence follow inflammation, tumour, proud flesh, and the like. Even Hippocrates^a has condemned this method, when he says; *Necesse est, ulcus in tumorem assurgere; nam si sana caro hinc atque hinc vinciatur, in medio vero non maxime ibi tumebit, et colorem mutabit, quomodo ergo ulcus hæc effugiet? necesse ergo est, ulcus decolorari, et materiam huc exprimi, unde lacrymabitur et non suppurabit, ossa vero et quæ abscessura non essent, abscedent;* “It must necessarily cause the wound to rise up into a tumour; for even if sound flesh is compressed or bound on all sides, and left free in the middle, it will there swell greatly, and alter its colour; how then is it possible for the wound to escape these? The wound must therefore of necessity be discoloured, and the juices will be there forced out, whence it will not suppurate, but weep or distil a sharp water, and bones will be separated or cast out which ought to have been retained.” And he afterwards adds, that he speaks of this the more largely, that every body might reject this ill method of deligation, which was used by many. What else has been said concerning the cure of wounds, ought here also to be observed; and if part of the bone is laid bare by the wound, it will be convenient to use those methods which were proposed under wounds of the head exposing the cranium. But a seldom removing of the dressings convenient in most other wounds, as we before observed, will be more especially useful in these; because great care must be always taken not to disturb the situation of the replaced fragments.

Now altho’ an exact regimen may not seem to be so very necessary for a simple fracture in a healthy person, yet it must be observed, that no worse accident can happen here, than an inflammation supervening the fracture; for then the bandages must be

^a De Fracturis Textu 49. Charter. Tom. XII. pag. 234, &c.

taken off, and such things applied as are proper to remove the inflammation, which might possibly have been better prevented. Phlebotomy therefore, with a thin diet, will be extremely convenient, more especially in those of a full habit, inclined to inflammations. Every thing must therefore be avoided which augment the quantity or motion of the circulating humours. But more especially these cautions are necessary to be observed for the first days, when there is the most danger of an inflammation. Hence Hippocrates ^b pronounces; *Dieta autem illis, quibus ab initio nec vulnus adest, nec ossa eminent, sufficit non adeo tenuis et exquisita (ὑποφαύλη) minus tamen cibi sumant, usque ad decimum diem; præsertim cum quiescant. Adhibeantque ex obsoniis mollibus, quæ modice alvum sollicitent, sed a vino et carne abstineant: postea paulatim se reficiant;* “ But the diet for those who from
 “ the beginning have no wound nor distortion of the
 “ bones, need not to be so low and exact; but let them
 “ eat sparingly until the tenth day, especially when
 “ they have no exercise. And let them use soft shell-
 “ fish, which gently excite to stool; but let them
 “ abstain from wine and flesh: afterwards they may
 “ by degrees indulge themselves.” But when a fracture is accompanied with great tumour, or violent inflammation, those remedies must be speedily used, and boldly repeated according to the urgency of the symptoms, which we recommended in the cure of contusions § 334. and at the same time a very thin diet will be proper.

S E C T. CCCLVII.

THEN follows a concretion or union of the parts by a callus, within the space of betwixt 20 and 70 days; sooner or later, according to the age of the patient, the thickness of the

^b De Fracturis Textu 45. Charter. Tom. XII. pag 181, &c.

bone, the incumbent weight it is to sustain, and the season of the year.

The third thing required to be done in the cure of fractures in general (§ 347. numb. 3.) is to procure a union or concretion of the replaced and retained fragments with each other; and if there is any loss of substance in the bone to procure a regeneration of it. But it has been customary with physicians and surgeons to call that substance a callus, by the interposition of which the fragments are united to each other. But what a callus is, and how it is generated, has been explained in the commentaries on § 343, and 347. numb. 3. For it there appears, that the divided parts are united, and the lost substance repaired, by the ingested aliments converted into healthy animal fluids, derived to the parts thro' sound vessels, with a proper impetus, and in due quantities. Art does nothing more in this case, than replace and retain the fragments in their proper situations; for all the rest is performed by the fabric of the healthy body. Therefore it need only be enquired whether any thing is defective with respect to health; and when that defect is known, to correct it by art: and in the commentary on § 346. we treated of the chief causes which have been observed to retard the cure, or render it impracticable.

But the time in which the fragments usually conjoin, varies upon many accounts even in healthy people. And therefore Hippocrates^b having spoken of a fracture of the cubitus conjoining within thirty days at most, adds afterwards: *Nihil autem perpetuum est: multum enim et natura a natura, et ætas ab ætate differt*; "But there is nothing of this constant; for the natures or constitutions, as well as the ages of patients are very different."

^b De Fracturis Textu 41, 42. Charter. Tom. XII. pag. 179, 180.

But the chief difference of the time required for the cure of fractures depends on the

Age.] For in young subjects the consolidation of the fracture is the soonest made; but then in them often arises too great a luxuriancy of the callus. In old age the time required is much longer; for, at that time, the body rather decreases: whence it is found extremely difficult to procure a regeneration of the lost substance, or a reunion of the divided parts in such people. But a middle age is of all the best; for then indeed the fracture conjoins more slowly than in youth; but it unites more firmly; nor is there so much danger of a luxuriancy in the callus. It was said in the commentary on § 346. that a fracture of the humerus in new born infants has been cured within twelve days time; whereas in adults the like cure requires thrice as long a time; and in old people the time required is still much longer.

The thickness of the bone.] The bones vary in thickness according to the weight they are to sustain or the strength of the muscles which they are to support and direct; whence again it has been observed, that (*cæteris paribus*) so much a greater length of time is required for the consolidation of a fracture, as the bones are of a greater thickness. Thus Hippocrates^b says, that the os femoris takes fifty days to conjoin it; the bones of the leg and humerus, forty days^c; those of the cubitus but thirty days at most^d; fractured ribs require twenty days^e, and the bones of the fingers as many days^f, etc. Whence the cure of fractures of the bones are usually completed within the space of twenty to seventy days time; since within that term, the os femoris, which is the largest bone in the whole body, is usually consolidated, in a healthy man of a middle age, when no ill accident opposes. But when large fragments are separated and removed, there is then a

^b De Fracturis Charter. Tom. XII. pag. 223.

^c Ibid pag.

220. & pag. 191.

^d Ibid. pag. 179.

^e De Articulis ib.

pag. 394.

^f De Fracturis ibid. pag. 194—197.

large portion of the substance of the bone to be regenerated, which will require a much longer space of time: as is evident from the instance alledged in the commentary on § 343, where a fragment of the tibia was separated, to the length of four fingers breadth; for there the space of ten months was required, before the patient could safely stand upon the fractured leg.

The incumbent weight.] For the callus formed in the fractured part remains a long time softer than the other substance of the bone. If therefore the fractured bone is once used to sustain the whole weight of the body, when a person walks, it is evident that a longer time will be required before this can be safely attempted. Hence a less time is required for the cure of the os humeri than for the bones of the leg; and more especially when both bones are broken. Hippocrates ^g says, that a fracture of the os calcis takes sixty days for the cure, whereas fifty days are sufficient for a fracture of the femur: but he had before observed, that the os calcis is placed directly under the tibia; whence it is evident, that this bone sustains the whole weight of the body. In treating of a fracture of the bones of the hand and foot he observes ^h, that all of them are perfectly curable within twenty days, excepting those bones of the foot which are connected to, or placed directly under the bones of the leg: for then thirty days are required to a compleat cure, if the patient is willing to lie so long, as many will not, because they think the disorder trifling, and therefore it is that most of them are not perfectly well cured. For the feet sustain the whole weight of the body.

Therefore before the patient is suffered to have the use of his limb, the prudent surgeon ought to examine whether the callus is sufficiently firm in the fractured part; to do which the limb is to be taken hold

^g De Fracturis Charter. Tom. XII. pag. 206.

^h Ibid. pag. 195, &c.

of on each side the fracture by two assistants, who are then to make a gentle attempt to bend it in the part of the fracture, while the surgeon in the mean time applies his fingers over the callus. If now any looseness or the least bending of the bones can be perceived, it is a sign the callus is not yet sufficiently indurated; whence might follow a new fracture or a deformity and incurvation of the limb, or at least the callus, being as yet soft, might be expressed from betwixt the bones by the weight of the body, so as to form a protuberance, which would at the same time diminish the due length of the limb. But in the mean time, as the diseased limb is obliged to be kept at rest for so long a space, care must be taken not to let the adjacent articulation become rigid; because an ankylosis or stiff joint has been frequently observed to arise merely from a want of moving it: and therefore during the time of the cure, the surgeon ought prudently to move the articulation at proper intervals, not suffering the patient to move it, lest by an imprudent agitation the fragments might be again displaced, after they have been properly reduced.

Though the fragments have been ever so well replaced, yet it is best to make a careful examination of the parts every time that the dressings are renewed, and to make a comparison with the sound limb, in order to observe whether they are both of the same length and figure: for if any defect as yet remains, it may be corrected while the callus is flexible; for when it has acquired a bony hardness, it will very difficultly, if at all, admit of an alteration. Whence Hippocrates¹ justly observes, *Quod si alligatis ferulis suspicio sit, ossa non recta concurrere; vel aliud quid ægrum molestet, ubi dimidium temporis (requisiti ad integram curationem) præterierit, vel paulo ante, solvere oportet, atque iterum deligare:* “ That if there is any room to
 “ suspect that the bones are not properly closed after
 “ the splints are tied on; or if any thing is trouble-

¹ De Fracturis. Charter. Tom. XII. pag 181.

“ some to the patient, when half the time necessary
“ for the cure is expired, or a little before, it will
“ be proper to remove the dressings, and reapply
“ them again.” But we need not perhaps entirely
despair of correcting a deformity, if any remains,
even after the whole time is elapsed, usual for the cure
of fractures; for observations confirm the possibility
of this practice, which may succeed more especially
in younger subjects. A youth of sixteen years old
had a fracture of the femur, which through negligence
was found, nine weeks afterwards, to be half a foot
shorter than the other thigh; which would have oc-
casioned the patient to go lame all his life time: but
a very skilful surgeon, examining the place of the frac-
ture, found that the ends of the fractured bone were
drawn up and conjoined by the sides of each other.
The patient being very robust, and the callus yet re-
cent, induced him to cause the limb to be violently
extended by assistants with slings, and by pressing with
his hands on each side at the same time, he reduced
the fragments to their proper situations without any
pain to the patient: thus the limb was restored to its
due length so happily, that within the space of a
month afterwards the young man could walk with-
out any manner of halting^k. It has been even ob-
served, that the fragments sooner consolidate in such
a case, than they unite with each other after being
lately broken: which is also confirmed by another re-
markable case from the same author^l; namely, a man
having fractured both legs, was well cured; but un-
luckily he broke one of his legs in the same place
again, six or seven weeks afterwards, and within
twelve days time from the reduction of the fragments,
the parts were so firmly conjoined, that he could con-
veniently move and elevate the leg. This second ac-
cident made the patient more cautious to avoid the
like again; but three months after he was thrown

^k De la Motte Traité complet de Chirurgie, pag. 194, &c.

^l Ibid. pag. 242, &c.

from a horse, and broke his leg again in the same place; but yet the cure happily succeeded, and in a short time, almost without any deformity.

But when the ends of the fractured bones do not unite together, but in a manner cicatrize and remain separated, then the case is much more difficult. That this accident does sometimes happen, is evident from what has been said in the commentary on § 346. And if it proceeds from a defect in the growth or nutrition of the bone, from some disease, there is then no remedy for it. But if the consolidation of the bone only ceases for a time, as we mentioned to have been sometimes observed in women with child, the cure must then be deferred till they are delivered. But whether or no the method which Celsus^m proposes, may be of service in the like cases, seems a matter of doubt; for he says, *Si quando vero ossa non conserbuerunt, quia sæpe soluta, sæpe mota sunt, in aperto deinde curatio est. Possunt enim coire. Si vetustas occupavit, membrum extendendum est, ut aliquid lædatur: ossa inter se manu dividenda, ut concurrente exasperentur, et, si quid pingue est, eradatur, totumque id quasi recens fiat. Magna tamen cura habita, ne nervi musculive lædantur:* “ But if the bones do not firmly
 “ consolidate, either because they have been fre-
 “ quently separated or agitated, even then the cure
 “ is not difficult; for they may unite. If the case is
 “ of long standing, the limb is to be extended, to
 “ make some injury: the bones are to be divided by
 “ the hand, and made rough by rubbing them a-
 “ gainst each other, that if any fat interposes it may
 “ be rubbed off, and the whole be rendered as if it
 “ was a new fracture. But great care is to be taken
 “ not to injure any of the nerves or muscles.” His whole design seems to consist in making a fresh wound of the bones, by rubbing them against each other; but if any splinters are thus broke off, they may occasion much mischief. It may perhaps be bet-

^m Lib. VIII. cap. 10. pag. 541.

ter to commit such a case to nature only, who is often observed to operate wonderfully for the patient's benefit. A man had a transverse fracture of both bones of the cubitus, at the distance of four fingers breadth from the carpus: he would neither suffer the bones to be replaced, nor any bandage to be applied, for fear of the pain, nor yet would he suffer the limb to be at rest, which prevented the consolidation of the fragments, and formed (in a manner) a new joint in the fractured part, with which he afterwards survived without any considerable pain or inconvenience. After his death, one of the surgeons who had seen the fracture, dissected the arm, and found that the ends of the upper fragment had acquired a round figure, which corresponded to cavities of the like shape in the ends of the lower fragments. The periosteum was grown thicker round the divided parts of the bone, and formed as it were a ligament to confine and strengthen the new articulation. Even the cavities formed in lower fragments were much depressed before, and much more elevated behind; so as easily to permit a flexure of the joint forwards, and prevent too great an extension of it backwards, almost in the same manner as in the joint of the elbow. These bones, we are toldⁿ, were preserved by the celebrated du Verney, among his anatomical rarities.

Sometimes the growing callus is observed to rise above the equal surfaces of the bones, especially in younger patients, who have their solids most soft and lax, and their juices more redundant; and this happens much in the same manner as proud flesh is formed by a luxuriancy of the vessels less pressed in wounds of the soft parts. This more especially happens when the repullulating and as yet soft vessels are too much distended by the juices, too impetuously moved in a fever; for the juices are sometimes sent to the parts

ⁿ Nouvelles de la Republique des Lettres l'an 1685. pag. 118, &c. & in Actis Erudit. mense Novemb. 1685. pag. 513, &c.

so abundantly, that Galen ° says, he has often seen the bloody juice poured out under the entire skin, that invests the fracture, so as to fill out the bandages. In such a case, it will be convenient to use such remedies as diminish the quantity of the juices, and abate their force, or drive them from the injured part. Therefore bleeding, and such purges as act without inflaming, will be here serviceable, joined with a spare diet, sufficient to support life without augmenting the quantity of the juices. A gentle friction of the parts will likewise be of service to carry off the too great redundancy of the juices there accumulated; to which add a more strict compressure, that the too lax vessels may be better secured to resist the impulse of the distending humours. All which are very well observed by Celsus P, for if the callus grows out too much, so as to form a tumour in the place, he says: *Diu leniterque id membrum perfricandum est ex oleo et sale et nitro, multumque aqua calida salsa fovendum, et imponendum malagma, quod digerat, adstrictiusque alligandum: oleribusque, et præterea vomitu utendum, per quæ cum carne callus quoque extenuatur: confertque aliquid de sinapi cum ficu in alterum pariter membrum impositum, donec id paululum erodat, eoque evocet materiam. Ubi his tumor extenuatus est, rursus ad ordinem vitæ revertendum est:* “ That limb is to be gently
 “ rubbed for a considerable time, with a mixture of
 “ oil, salt and nitre, and to be well fomented with
 “ hot salt water, after which a discutient cataplasm is
 “ to be applied, and the bandages drawn tighter:
 “ laxative pot-herbs, and also a vomit, are to be used,
 “ which both diminish the flesh and callus: it will
 “ be also of some use to apply a fig and mustard to
 “ the opposite limb, and let it remain till it has blis-
 “ tered a little, and by that it may cause a revulsion
 “ of the matter. When the swelling is extenuated

° Commentario 3. in Hippocrat. de Articulis. Charter. Tom. XII. pag. 394.

P Lib VIII. cap. X. in fine. pag. 542.

“ by these means, the patient may then return to “ his ordinary course of life.” But if the superincumbent weight of the body shall have forced out the callus from betwixt the bones in the form of a ring, by an imprudent use of the limb too early; in that case the limb ought to be extended again to its due length, and the exorbitant callus forced within its due bounds by an external pressure.

But when a deficiency of the callus is feared either from too great a compressure of the part, or from any other cause; then a looser application of the bandages, with emollient fomentations, and a more full diet, joined with such medicines as excite the languid motion of the juices, will be found more particularly useful. For this purpose, namely, to procure a more successful reproduction of the callus, Hippocrates^g directs, that if the limb is unbound after the splints have been used, it ought to be fomented, and afterwards bound up more gently, and with fewer bandages than at first. And Galen^r, in his commentaries on this place observes, that Hippocrates on the first day increased his number of bandages, and applied them more strictly, till he came to the splints; but after the seventh day, laying aside the splints and the rest of the apparatus, he suffered the part to remain at rest until the twentieth day, for the nutrition of the callus; and then he derived the matter of the callus to the part, by pouring on warm water, whereas in the beginning he increased the number and stricture of his bandages, to prevent the afflux of the same matter thither. This is well expressed by Ægineta^f, when he says: *Quædam fracturæ sine callo manent, ultra definitum naturæ limitem; vel ob continuas resolutiones, vel ob immoderatas fomentationes, vel ob importunum motum, vel ob multitudinem fasciarum, vel ob totius corporis atrophiam; a quibus et tenuius membrum fieri*

^g De Fracturis textu 43. Charter. Tom. XII. pag. 180.

^r Ibidem. pag. 181.

^f Lib. VI. Capit. 110. pag. 101.

accidit. Oportet igitur et alias occasiones cum studio removere, maxime autem atrophiam: partim calidioribus alimentis materiam attrahentes ad partem, uti et nutrimentum sufficiens et balnea et aliquam animi hilaritatem subministrantes. Signa vero callo jam firmatorum sunt, et alia quidem, maxime vero fascias madescere, nullo etiam vulnere oborto, etc. “ Some fractures remain without a callus, beyond the time allotted by nature for its formation; either because of the frequent undressings, an immoderate use of fomentations, unseasonable motion, a multitude of bandages, or even from an atrophe of the whole body; from whence also the limb shrinks or becomes less. These and other impediments ought therefore to be studiously removed but more especially the atrophe; partly by more warm or spicy aliments, and things which derive the juices to the part, with a sufficient quantity of nourishment and the warm bath, with whatever else tends to render the mind cheerful. But the signs that the bones are grown firm by a callus, are, among others, principally a moistening of the bandages, when there is no wound made, etc.” As for what is to be thought of the lapis osteocolle and other such remedies, to promote a callus, we have already declared in the comment on § 347. numb. 3.

But the callus with which the fractured bones are conjoined, at length puts on the nature and firmness of a bone; insomuch that we are assured from observations, that the bone will afterwards break rather in any other part than in the callus, or remains of the old fracture. Yet Ruysch tells us ^t, that he found the bones of a hen, which had been broke and conjoined by nature in such a manner, that only the spongy substance of the bone was regenerated, without the hard external lamella, which by its firmness naturally defends and secures the former. But it is evident, that bones thus conjoined may very easily be

^t Thesaur. Anatomic. 8. n°. 49.

broke again, and that this case sometimes happens in human bones he is apt to believe, because they are sometimes broke again by the slightest causes.

There is yet another remarkable observation in the same author ^u, by which it appears, that the severest pains and symptoms may supervene in a fracture, though all proper care has been taken. For he kept by him two thigh bones, which had been so ill managed after a fracture, that the fragments rid over each other; and what was more remarkable, he found various spines or exstoses, many of which being sharp and slender might wound the adjacent parts; and these spines were not only found about the circumference of the callus of the fracture, but they also arose from the sound part of the bone above the fracture, and he perceived some of them arise out of those small holes into which the tendinous fibres are usually inserted, which fibres being tore off from the bone in a fracture or a luxation, he believed might occasion the like spines or exstoses. This opinion of his we find more largely confirmed by similar observations on the bones of other animals, which he there relates. And although it may not be easy to foresee or prevent the like accidents, yet it is thence evident, that we ought not rashly to impute those consequences to the surgeon, (who may be often one of the best merit) which no art or industry can prevent, and which may attend a fracture that has been most exquisitely treated.

^u In Museo Anatomico sine Catalogo rariorum, &c. Theca A: Repositor. V. no. 1 & 2. pag. 129, 130.

Of LUXATIONS.

S E C T CCCLVIII.

A Luxation is the receding of the head of some moveable bone out of the cavity in which it naturally turned, accompanied with an impediment or loss of its motion.

A luxation, called also a ^a dislocation, is the displacing of a bone from its natural seat; and in this sense it denotes any kind of change in the natural site of the bones. But from use, which principally determines the signification of words, this term has been restrained to signify only the displacing of bones from their articulations, where they naturally resided. But Celsus ^b, in treating on luxations, makes a two-fold distinction of it, when he says: *Moventur autem ea sedibus suis duobus modis. Nam modo, quæ juncta sunt, inter se debiscunt: ut cum latum os scapularum ab humero recedit, et in brachio radius à cubito, et in crure tibia à sura; et, interdum saltu, calcis os à talo; quod raro tamen fit: modo articuli suis sedibus excidunt:* “ But the bones are moved out of their places two
 “ ways. For some bones that are joined together
 “ are so displaced, that there is a space left betwixt
 “ them: as when the broad scapula recedes from the
 “ humerus, and the radius from the ulna in the cubi-
 “ tus, and the tibia from the fibula in the leg; and
 “ sometimes in leaping, though but rarely, the cal-
 “ caneum from the astragalus: in the other way the
 “ heads of the bones are removed out of their places.”

^a Cael. Aurelian. Morb. Chronicor. Lib. II. cap 1. pag. 347.

^b Lib. VIII. cap. 11. pag. 542.

Since therefore a luxation, properly speaking, takes place only in the articulated or moveable bones, the definition above given is a very proper one. For in every articulation there are two bones to be considered, that which receives, and the other which is received. The concavity in the receiving bone, which takes in the head of the other bone, is, by the ancients, termed *κοτύλην*; and the projecting part of the other bone, which is received into that cavity, is termed *ἄρθρον*, or simply the ^c joint. Hence we have an excellent definition of a luxation given us by Ægineta ^d; namely, that it is *elapsus articuli ex proprio cavo in alienum, à quo motus arbitrarius impeditur*: “the slipping out of the head of a bone from its proper cavity, into some improper place, whence the voluntary motion thereof is obstructed:” for if the motion is not obstructed at the same time, it cannot be properly called a luxation, even though the head of the moveable bone is out of its cavity in which it naturally moves. For in the wonderful articulation of the lower jaw, the round heads of that bone are indeed placed in cavities deep enough, fixed at the bottom of the *ossa squamosa*, whence the *processus zygomaticus* arises, and yet by means of a cartilaginous elastic plate interposed between the heads of the lower jaw, they are allowed to go out of their sinuses, and return into them again without any injury of their motion. It was even necessary that this articulation should admit of this motion, for the lower jaw to perform its several actions in all manner of directions.

S E C T. CCCLIX.

WHICH may be done either wholly or but in part; whence we have a luxation and a distortion.

^c Gotræi Definit. *ἄρθρον*. pag. 77.

^d Lib. VI. cap. 111. pag. 101.

It is easily conceived that the articulated head of a bone may either slip quite out of its natural cavity, or else be so displaced as to remain partly in and partly out of its said cavity. Yet Hippocrates ^a denies that this can take place in all articulations: for he concludes, that as the head of the os humeri and os femoris are round, and are received into cavities of the like shape, they must of necessity either go quite out of their cavity, or if they go out but in part they must slip back again into those cavities. But it is sufficiently evident, that this may happen in the other joints. Ægineta ^b, in his definition of luxations, adds: *Differentias alias dicere non habemus, nisi solum illam quæ secundum majus et minus contingit. Omnino enim elapso articulo communi generis nomine ἐξάρθρημα dicitur; leviter vero dimoto, vel usque ad supercilia cavitatis prolapsò ἀρθρήματα;* “ We have no other differences “ to mention, except that only which arises from “ more or less: for the head of a bone slipped perfect- “ ly out is called by the general term a luxation; “ but being slightly displaced, or only slipped out to “ the edge of the cavity, it is termed a subluxation.” It was customary to prefix the preposition ἀρθρῶ, *sub*, before words to diminish their signification, or denote a slighter affection, whence some physicians say parapoplexia for a slighter kind of apoplexy, paracy-nanche for a slight quincy, *etc.* and therefore Vesalius ^c seems not to have used these words with proper exactness, when he says that luxations arising from a flux of humours into the articulation are termed ἀρθρήματα; but those from violence ἐξάρθρηματα. For it will appear from what follows, that a true or perfect luxation may arise from a flux of humours into the cavity of the joint. But it is usual to call that species in which it is but partially displaced, a subluxation or distortion. And yet the term distortion also signifies commonly the displacing of muscles or

^a De Articulis Charter. Tom. XII. pag. 427.
cap. 111. pag. 101.

^c Chirurg. magn. pag. 921.

^b Lib. VI.

tendons by some external violence; as it also signifies a distraction and twisting of the ligaments from the same cause. Therefore such an imperfect or partial luxation is with less ambiguity termed a subluxation.

S E C T. CCCLX.

THE worst species of which disorder is, when the epiphysis or head of a bone happens to separate from its diaphysis or body.

In the larger bones which are joined to others by some moveable articulation, it is observable, that each end is distinct from the rest, or body of the bone; which is most conspicuous in the bones of abortive and new born infants. For these bones themselves were once wholly cartilaginous, and in the middle of their length, a small round grain of bone first began to appear, which soon spreading itself each way longitudinally, changes the cartilage into bone^a. But both extremities of the bone remain a long time cartilaginous, and in the middle of these likewise the cartilage begins to change into bone, which by degrees spreads itself throughout the whole mass of the cartilage. But for a long time after there remains something of a cartilage betwixt the body and end of the bone, as, for example, in the thigh bone; by which cartilage the end seems in a manner to be glued to the body of the bone, till at length this cartilage also ossifies, and causes the extremities and body to grow into one continued bone^b; so, however, as to leave some mark or division externally for a considerable time, till at last that mark or line is also obliterated^c. These extremities of the bones, as of the os femoris, distinguished by an intermediate cartilage,

^a Albini Icones Ossium foetus humani, &c. pag. 101. pag. 156.

^c Ibid. pag. 102.

^b Ibid.

or a line from the body of the bone, are called its epiphyses; and in younger animals, these epiphyses are separable by a small force from the body of the bone, as is daily observed in the first months. But the ligaments which every way invest and secure the articulations, grow out from those places where the epiphyses join with the body of the bone; and therefore Columbus^d would have this to be the principal use of the epiphyses; namely, that the ligaments, which are continued to no other part, might arise from their conjunction in those places with the bones. And Havers^e has also observed, (as we said in the comment on § 343.) that in those places whence the ligaments arise, the periosteum, which hitherto covered the whole surface of the bone, there departs from it, and climbing over the ligaments which there arise, it proceeds to the next bone.

If therefore the epiphysis is separated from the body of the bone, it will evidently disturb the motion of the joint. But yet it does not seem so proper to call it a luxation, because the end of the moveable bone continues in its cavity, in which it naturally moves; but in the definition given at § 358. it is the receding of the head of the bone from its cavity which constitutes a luxation: whence this disorder might perhaps have been better referred to fractures. Galen^f seems to reckon it among the species of fractures, calling it ἀπαγμα, whereas he comprehends the other fractures under the general name καλάγματα: and he observes that the word ἀπαγμα is peculiar to physicians, being disused by most other people; but that it signified that species of fracture, in which the articulating head of the bone is broke off: But as this kind of fracture is often taken for a luxation, therefore it is usually referred hither. But this accident more especially happens in luxations of the femur,

^d De re Anatomica, lib. I. cap. 2. pag. 5.

^e Osteolog.

pag. 17, 18.

^f Method. Med. Lib. VI. cap. V. Charter.

Tom. X. pag. 145.

as they are called, but which are very frequently a separation of the epiphysis from the body of the bone, or else a fracture in the neck of the femur itself, which is there very small. For Ruysch ^g tells us, that a celebrated surgeon opened the bodies of eight lame old women, and always found the neck of the femur had been fractured, but never luxated. But since in young infants the epiphyses of the bones are more easily separable by a less force; therefore this injury more frequently happens to them; especially if an infant suddenly throws its body backward while it is carried in the arms; for then there is great danger of separating the epiphyses of the femur, or of breaking the neck itself of that bone, which occasions them to be lame afterwards during life, while the body of the bone, being separated from its head, is contracted upwards by the muscles. But wonderful efforts of nature have been often observed, in order to relieve this injury: for Ruysch found, in the body of an old woman who had this disorder, that the neck of the femur was quite absent, and that nature had substituted various hard, thick, and round ligaments in its place, by means of which the round head of the femur was connected to the rest of the bone ^h. It is easily apparent, that the difficulty is much greater in the cure of this disorder, than in a luxation properly so called; for a luxated bone being reduced in its natural seat, is easily retained there, provided the limb is at rest: but when the epiphyses is separated from the body of the bone, the muscles inserted into the bone do by their natural contraction draw it from thence; whence a shortening of the limb, and a defect in its motion almost constantly follows.

^g Ruysch Thesaur. Anatom. VIII. n. 103.
Thesaur. IX. n. 74.

^h Idem

S E C T. CCCLXI.

THE cause of which is some extending, distorting, or expulsive force acting externally.

No luxation can follow without some external force, if the investing and articulating ligaments are in their natural state: even a very great force is required to disjoin the bones in adult and strong people; as is very evident from the strength of the investing ligaments of the joints. But any force externally applied will act in one of the three ways mentioned in this aphorism.

S E C T. CCCLXII.

OR some internal cause, formed in the cavity of the joint, and thrusting out the head of the bone.

The ligaments which connect the articulated bones arising from those places where the epiphyses are conjoined to the rest of the bone, invest the whole articulation in the manner of a capsule or bag, so as to form a cavity closed on all sides; nor can they permit any thing to enter from without, nor suffer any thing to escape from within. In this cavity of every articulation are contained the two ends of the receiving and received bone, incrufted on all sides with a cartilage; and in the larger articulations, furnished with considerable glands, denominated from Havers, their first discoverer. One large gland of this kind is seated in the articulation of the femur, and four or five smaller are visible in the articulation of the knee^a. Besides these, there are many smaller follicles or

^a Clopton Haversi. Osteolog. pag. 190—201.

drains in the surface of the ligament which invests each articulation. These glands, which by anatomical injections appear to consist of innumerable small vessels, serve to separate and furnish a mucus, like the white of an egg^b, and of a brackish taste. But the cartilaginous ends of the bones contained in the cavity of the articulation, not being covered with any perichondrium, seem to transude a thin medullary oil, which is lodged in considerable quantities in the cavernous parts of the bones, near their articulations. In the larger bones of a horse, Dr. Havers^c could perceive these pores with his naked eye, through which the medullary oil transfused into the cavity of the articulation; and the same thing is confirmed by many other experiments. For when the joints of a dead body are preserved entire until all the mucilage is gradually consumed, or perhaps absorbed, a mere oil is found in their cavities, which the same author has also observed in the joints of the fingers^d. Animals that are killed, after long and violent exercise, have very little medulla in the cavities of the larger bones; whereas in well fed and idle animals the medulla abounds. From all which it seems to be sufficiently evident, that the medulla of the bones, transfusing their extremities, mixes with the mucilage separated by the glands; so that from a mixture of these two is formed that liniment with which the extremities of the articulated bones are anointed and lubricated, that they may slide easily upon each other without much attrition. And for this reason when the fat or oil is wanting, or consumed by too much labour, old age, or diseases, a grating or crackling of the joints is perceptible, from the attrition of the too dry ends of the bones against each other. Add to this also, that the thin dew or vapour is likewise discharged from the smallest exhaling arteries into the cavities of the joints, as well as into all the other cavities of the

^b Clopton Haversi. Osteolog. pag. 200. 206.

^c Ibid. pag.

173.

^d Ibid. pag. 372.

body, whether large or small, with which we are as yet acquainted.

There is therefore a threefold humour meets in the cavities of the joints; namely the universally perspiring vapours, the medullary oil, and the mucilage separated by the glands there seated; from all which mixed together, arises that lubricating liniment, which being attenuated by the warmth and mutual attrition of the bones, is returned or absorbed in the same quantity in which it was sent into the joint: but if the absorption or return of this liniment is from any cause impeded or diminished, while the fecerning and expulsive causes continue, the liniment will be then accumulated so as to distend and weaken the ligamentary capsule of the joint; whence the prolapsion of the articulated head of the bone from its proper cavity may easily arise from this cause. That tumours of a considerable magnitude often arise about the joints from this cause, is testified by innumerable practical observations. And Havers^e demonstrates, that the medullary oil which transudes thro' the cartilaginous ends of the bones into the cavity of the articulation, is very apt to concrete or stiffen, if not duly attenuated by the motion and attrition of the bones against each other. For he tells us, he has often observed this oil stagnant and concreted in the pores (through which it usually transudes) in such animals as have been fattened without using exercise; and that at the first view he imagined the same to be small glands, but he afterwards found them to be nothing more than a concreted oil.

This cause of luxations, with many more particulars relating to this disorder, we meet with in Hippocrates^f; for in treating on the articulations, he says, *Mucus omnibus natura inest, et quum purus fuerit, sani sunt articuli, ideoque facile moventur, utpote lubrici inter se. Labor autem et dolor oritur, quando a*

^e Clopton Haversf. Osteolog. pag. 174.
mine cap. 3. Charter. Tom. VII. pag. 361.

^f De Locis in ho-

carne laborante fluit humor. Imprimis quidem rigescit articulus, non enim lubrica est humiditas ex carne affluens. Deinde utpote copiosa et valde dispersa, neque ex carne irrigata, semper resiccatur; quumque illam ob multitudinem articulus capere non possit, effluit, maleque concretescens nervos, quibus articulus colligatur, attollit, relaxat et dissolvit: et ob illud claudi fiunt magis minusve, prout illud magis minusve fit; “ That all of them
 “ are naturally supplied with a mucus, which when
 “ pure, or of a healthy consistence, the articulations
 “ are found, and therefore easily moveable, as being
 “ slippery upon each other. But pain and a difficult
 “ motion arises in the joint, when the juices flow to
 “ it in too great a quantity from a bad habit of body;
 “ for their moisture distilled from the vessels or flesh
 “ is not lubricating, and therefore the articulation will
 “ more especially become stiff. On the other hand,
 “ the articulation will also become stiff or dry, when
 “ the mucus is too abundantly and powerfully dissi-
 “ pated, and not supplied again from the soft parts;
 “ and when the dried mucus is so redundant, that it
 “ cannot be confined within the articulation, it then
 “ escapes, and causes a bad concretion or rigidity of
 “ the ligaments which connect the joint which is thus
 “ distorted, relaxed or dislocated: and from hence
 “ the patient becomes lame more or less, according
 “ to the degree of the disorder.” And, in another
 “ place §, *Quibus ab ischiade diuturna vexatis ischium excidit, et rursus incidit, illis mucii innascuntur;* In
 “ those who have the head of the femur slip in and
 “ out, after being long afflicted with sciatica, there is
 “ an accumulation of the mucus.”

If now we also consider that inflammation may arise in these parts, since the ligaments and glands of the articulations appear, from anatomy, to be furnished with innumerable arteries; from hence therefore a suppuration may follow, with an accumulation of the formed matter within the cavity of the articulation,

§ Sect. VI. Aphor. n. 59. Charter. Tom. IX. pag. 289.

etc. and by these means may be produced all those symptoms which arise from a collection of the mucilage of the joints from not being absorbed or returned again into the blood. That luxations very frequently arise from this cause, we are assured by M. Petit ^h, who ingenuously confesses that he learned this from his own errors. For when by a fall, or other accident, the trochanter major is urg'd upwards, it is evident that the head of the femur will be very forcibly pressed into the acetabulum or cavity in which it moves; whence the glands and round ligament there seated may suffer a violent contusion, which we know is often followed with an inflammation, suppuration, and accumulation, either of matter or mucilage within the joint. The ligaments being thus distracted and weakened, will be no longer able to retain the head of the femur in its situation, and the muscles inserted in the trochanters drawing the femur upward, will force out the head of that bone from its acetabulum, which will occasion an incurable lameness afterwards. 'Tis hard to discover this disorder at first, as the luxation follows not for a long time. If we know that such a contusion in the joint has preceded, and there remains a troublesome pain in the articulation, then bleeding, with a thin diet and cooling medicines are required, to prevent the inflammation, or remove it when present. It will be also very serviceable to keep the part at rest, and apply convenient fomentations; and thus may a luxation be prevented, when it is about to follow from this cause; and which being once formed, seems to be incurable.

^h Academ. des Sciences l'an 1722. Mem. pag. 159, &c.

S E C T. CCCLXIII.

TH E S E luxating causes (361, 362.) are assisted by every thing which extends, relaxes, or breaks the ligaments, whether the cause from whence they arise be external or internal.

'Tis the cohesion of the ligaments only which retains the articulated bones in their proper situations; which ligaments are required to be flexible, that they may give way to the various motions of the joints; and at the same time they are required to be so firm, as not easily to suffer too great elongation. It was before demonstrated, in the commentary on § 25. numb. 3. that too great a distraction is justly enumerated among those causes which weaken the solid parts of the body; whence too great an extension of the ligaments may dispose the joints to be easily luxated afterwards, tho' it does not immediately produce the luxation. The same is also true, if the ligaments do not sufficiently resist the distending causes, either through some weakness in themselves, or from a general relaxation of the whole habit. Therefore Celsus^a, in describing the general causes of luxations, says: *Omnes articuli, cum validis nervis comprehenduntur, excidunt aut vi expulsi, aut aliquo casu nervis vel ruptis, vel infirmatis; faciliusque in pueris et adolescentulis, quam in robustioribus;* " Since all the articulations are invested with strong ligaments, they
 " are displaced either by some expulsive force, or
 " from a weakness or rupture of the ligaments by
 " some accident; whence they more easily happen
 " in children and young people, than in those who
 " are strong." It is universally well known, that the solid parts are weaker and softer, or more easily distracted in young subjects; tho' there are even some adult, and otherwise strong people, who are found to

^a Lib. VIII. cap. 11. pag. 543.

have a great laxity of almost all the ligaments of their joints; and there are often tumblers, or posture-masters, that expose themselves for a public shew, who by the action of their muscles only, can luxate almost all their joints, and again replace them by the same means, so as to make their bodies turn almost into any shape, like a piece of wax. Hence Hippocrates^b justly observes, *Quod in luxatis facile restituendis multum naturæ a naturis differant, et multum cavum a cavo distet: nam hoc quidem facilius, illud difficulter superatur. Multum etiam differt nervorum colligatio, quibusdam laxa, quibusdam tensa, etc. Complures autem videre licet, qui ita humidi sunt, ut, ubi velint, sine dolore articulos suo loco moveant, et sine dolore restituant;* “ That there is a great deal of difference in
 “ luxations, as to their being more or less easily re-
 “ duced, according to the different nature of the
 “ joints, the cavity of one being much deeper than
 “ that of another; so that the bone will more easily
 “ slip out of one than the other. There is also a
 “ great deal of difference in their connection by the
 “ ligaments, some of which are lax, and others tense,
 “ etc. And we meet with several who have their
 “ joints so moist, that they can displace them, and
 “ restore them again when they please, and that with-
 “ out any pain.” He afterwards adds, that fleshy joints do not slip out so easily; but then they are more difficultly replaced, when out; whereas in lean people they are more easily replaced. He then confirms his discourse by the instance of oxen, which being emaciated towards the end of the winter, do very easily suffer a luxation of the femur.

But if the ligaments have been broke by any external violence, or if their continuity has been dissolved by any suppuration, erosion, etc. it is very evident that then a slight force may luxate the joint.

^b De Articulis, Textu 23, etc. Charter. Tom. XII. pag. 304, etc.

S E C T. CCCLXIV.

HENCE follow an alteration of the figure of the limb, with a tumour, excavation, a shortening or an elongation thereof; a distraction, immobility, and numbness, or palsy of the muscles below the joint; a compressure of the adjacent vessels, followed with pain, watchings, inflammation, an œdema, anchylosis, convulsion, a withering, and death, either of the part or of the whole body.

This aphorism comprehends those symptoms which usually accompany or follow after luxations.

An alteration of the figure, a tumour, or excavation.] Celsus ^a, in describing the signs which accompany every luxation, says, *Siquidem semper ea parte tumor est, in quam os prorumpit; ea sinus, à qua recessit*; “ That there is indeed always a tumour in that part to which the bone is thrust; and a sinus or cavity in the part from whence it receded.” But such an unusual tumour and preternatural excavation more especially appear when the dislocated joint is not much loaded with flesh, as in the shoulder and elbow: for in the thigh it is very difficultly discerned, because of the many muscles and circumjacent fat which invest the articulation. But in order to determine with certainty whether or no the joint is dislocated, Hippocrates ^b wisely directs to compare the injured limb with that which is sound: *Ad exemplum enim integri æstimare vitiatum oportet, neque spectare alterius hominis articulos, (quibusdam enim hominibus magis prominent articuli, quam aliis) sed ipsius laborantis, an integer vitiato dissimilis sit*; “ For the figure of the injured limb ought to be compared with that of a

^a Lib. VIII. cap. 11. pag. 543. ^b Hippocrat. de Articulis. Textu 34, etc. Charter. Tom. XII. pag. 310.

“ found one; and this not by inspecting the joint
 “ of another person, (for in some people the joints
 “ are more protuberant than in others,) but by ob-
 “ serving whether the sound limb differs from that
 “ which is injured in the patient himself.” But an
 alteration of the figure alone is not sufficient to de-
 monstrate that any joint is dislocated, for as Hippo-
 crates ^c likewise observes; *Multi enim articuli præ do-
 lore, aut alia de causa, licet ipsis non exciderint, neque-
 unt tamen eo modo, quo in sanis corporibus, figurari;*
 “ Many joints, through pain or some other accident,
 “ are prevented from resembling the figure of the
 “ same joints in healthy bodies, even though they
 “ are not dislocated.” Even though a preternatural
 excavation should appear in the place of the articula-
 tion, unless an usual tumour also appears in another
 part where the head of the bone is thrust, a person
 may be egregiously deceived, especially in the joint
 of the shoulder. Hippocrates ^d even says, that he
 knew several physicians of note, who believed the
 humerus was luxated, when they saw a cavity upon
 the shoulder from the depression of the head of the
 humerus below the acromion: and Galen ^e, in his
 commentary on this text of Hippocrates, relates that
 he had met with the same accident in himself. For
 when he was in the field of exercise, the master of
 the field perceiving a preternatural cavity in his shoul-
 der from the raising of the acromion, imagined that
 the head of the humerus was prolapsed into the axil-
 la, which occasioned him to extend Galen’s arm, and
 to make a needless attempt to replace the bone: but
 this being done with a violent extension made by se-
 veral assistants, Galen himself endeavoured with the
 fingers of his other hand to reduce the head of the
 humerus, but Galen finding no preternatural protube-
 rance in the axilla, advised them to forbear making

^c Hippocrat. de Articulis, Textu 34, &c. Charter. Tom XII.
 pag. 311.

^d Ibid. Textu 62. pag. 321.

^e Ibid. pag. 322, 323.

any farther extension; but they notwithstanding continued their extension, imagining that Galen requested them to forbear by reason of the pain; and if one more prudent than the rest had not come to his assistance, they would have pulled off the muscle. But by this perverse treatment, Galen perceived that a convulsion was beginning to invade his arm, and which he could not keep off, but by the continual pouring on of warm oil; as we mentioned once before upon another occasion in the commentary on § 164. From hence it is evident, how much caution is necessary in order to determine whether a joint is luxated, since the most skilful have been sometimes mistaken. Thus I saw an unhappy countryman, whose whole arm was invaded with a gangrene up to the shoulder, which being swelled with a true phlegmon, was by an ignorant fellow deemed and treated as a luxation of the cubitus, though by his strong and repeated extensions, he made the people imagine he excelled every body in the cure of fractures and luxations.

A shortening or elongation of the limb.] When the head of the bone is displaced from the cavity in which it ought naturally to move, then the muscles, which are inserted into that bone, do naturally contract and draw it upwards; whence it happens, that the dislocated limb is generally shorter than the other, in the manner we described in the commentary on § 343. in treating on the shortening of a limb from a fracture of its bones. But in some cases, though not often, the dislocated limb is elongated; and this happens when the displaced head of the bone is so sustained, that the muscles cannot draw it upward. Thus for example, the lower jaw being luxated on both sides, as Celsus^f observes, *totum mentum inclinatur, et in exteriorem partem promovetur, inferioresque dentes longius, quam superiores excedunt, intentique temporum muscoli apparent*; “ The whole chin will be

^f Lib. VIII. cap. 12. pag. 544.

“ inclined downward, thrust forward, the lower teeth
 “ will come out much beyond the upper, and the
 “ temporal muscles will be found upon the stretch.”
 For the heads of the lower jaw being prolapsed beyond the tubercles, which are placed before the cavities of its articulations, therefore they cannot be drawn back by the muscles of the lower jaw, which will therefore project out beyond the upper jaw. And Hippocrates §, treating on luxations of the femur, reckons it one of the signs which denote the femur to be luxated inwards, when the injured limb being compared with the other appears longer. For says he, *Ossi enim, quod à coxa sursum procedit ad pectinem, femoris caput inhæret, et cervix articuli cavo sustinetur*; “ The head of the femur is sustained against
 “ the bone, which is continued upwards from the il-
 “ chion to the pubis, and the neck of the femur is
 “ sustained against the cavity of the articulation:” and for these two reasons he judges the dislocated limb is rendered longer than the other. A shortening of the limb will therefore happen the most frequently and yet an elongation of it may likewise happen some times: but the case is still more rare for the luxated limb to be exactly of the same length with the sound one; yet Hippocrates observes, that this may happen when the head of the femur is displaced forwards; though he also adds, that such a luxation is seldom to be met with.

Immobility.] All those motions, whose performance requires the displaced joint to be in its natural state, can either not be performed at all, or at least but with great difficulty: and it is certain that all the motions of a limb cannot be performed in a true luxation, as they were usually performed when the limb was sound. As for instance, in the articulation of the humerus in its natural state, a person may describe an infinite number of cones with his extended arm, the vertices of all which cones may be conceived to ter-

§ De Articulis, Charter. Tom. XII. pag. 399.

minate in the cavity of the articulation, while their bases are described by the ends of the fingers: but if the head of the os humeri be displaced from its articulation with the scapula, those motions cannot be performed. The same is also true of the other articulations. Yet all the motions of a joint are not continually destroyed by a luxation; for frequently some of the motions remain, as Hippocrates^h well observes. For after having treated of such as have their arms shorter from the day of their birth, either from a luxation in the uterus, or from some other cause, he says, *Quibus vero virili ætate humerus excidit, nec restitutus fuit, summus humerus attenuatur, et magis excarnis fit; ubi autem dolore liberantur, non æque præstare possunt opera omnia, quæ requirunt, ut cubitus à pectore diductus in latera attollatur. Ad ea autem valent, quæcunque perficienda sunt, humero vel in priorem partem, vel in posteriorem, ad pectus adducto: nam terebra, ferra, secure, etc. utuntur, dummodo cubitum non admodum alte attollere necesse sit, etc.* “ But in those who
 “ have a luxation of the humerus in their adult age,
 “ without a reduction of it, the upper part of the
 “ arm becomes very small, and loses much of its
 “ flesh; and even those, who are free from pain,
 “ cannot well perform all the motions required to
 “ raise the arm, and move it from the breast to the
 “ side. But any person is able to perform these mo-
 “ tions when the humerus is displaced either forwards
 “ or backwards, being drawn towards the breast: for
 “ these securely use the saw, the terebra, &c. provi-
 “ ded it is not necessary to raise the arm up very
 “ high.” Hippocrates also points out in several
 places of the same book, treating of the different
 luxations, which of them destroy the motion of the
 joint, and in which of them the motions continue.
 So that under these restrictions an immobility of the
 limb is reckoned among the consequences of luxa-
 tions.

^h De Articulis, Textu 61. Charter. Tom. XII. pag. 320.

A distraction of the muscles.] The head of the displaced bone must necessarily press upon and distract the adjacent muscles; and at the same time the situation of the muscles inserted into or attached to the bone will be altered; whence some of the muscles will be shortened and others elongated. And on the same cause likewise depends the change of figure in the luxated limb. M. Petitⁱ, enumerating the signs which denote that the head of the femur is prolapsed backwards, observes that the glutei muscles are relaxed, but that the triceps seems like a very tense chord extended from the region of the pubis to the middle of the os femoris. When each head of the lower jaw is luxated, it is evident from the anatomical structure of the parts, how greatly the temporal muscles will be distended, *etc.* whence often convulsions and death itself follow.

A stupidity or numbness of the subjacent parts, or a palsy.] These happen when the prolapsed head of the bone compresses the large nerves adjacent; or as when the spinal medulla itself is compressed by a luxation of the vertebræ. Hippocrates^k, in treating on a luxation of the spine, observes, that when the upper part of the spine is dislocated inwards, the whole body becomes stupid and relaxed (*νεναρρωμένοι*) or paralytic. See what has been said in the commentary on § 170. numb. 1. γ. If now the head of the os humeri slips into the cavity of the axilla, it will compress the large trunks of the nerves which are there seated, whence it is evident that these symptoms will invade the parts below. When the head of the os femoris is luxated forwards, among other signs of its being so luxated Hippocrates^l reckons a suppression of urine, because then the head of the femur will be near the large nerves. But it would rather seem, that a compression of the nerves should produce an invo-

ⁱ Academie des Sciences, l'an 1722. Mem. pag. 163.

^k De Articulis, Charter. Tom. XII. pag. 390, 391.

^l Ibid. pag. 422, 423.

luntary discharge instead of a suppression of the urine. But Hippocrates ^m in another place takes notice, that if the spinal medulla is injured by any cause, at the first the patient neither voids the urine nor fœces; but when the disorder becomes inveterate, he discharges them both without his inclination; from whence it appears, that a suppression of urine may sometimes follow a compression of the nerves. If therefore the nerves destined to sense and motion are entirely compressed, it will form a compleat palsy with insensibility; but if the compression is only slight, it will impair and not totally abolish all the functions of the nerves; the subjacent parts will then suffer a torpidity, as Galen ⁿ well expresses it, being a disorder betwixt a palsy and perfect health of the parts.

A compressure of the adjacent vessels.] In the same manner as the head of the os humeri, prolapsed towards the axilla, often compresses the adjacent large nerves, so may it likewise compress the adjacent large blood-vessels which are there seated; and thus it may impede the influx and reflux of the blood to and from the subjacent parts; whence may follow a gangrene or a withering. See what has been said on this head in the commentary on § 161. and § 166.

Pain.] Such a disposition of a nervous fibre arising from the brain, as threatens a rupture or solution of its continuity, excites the idea of pain in the mind, as we said before in § 200. But a joint cannot be dislocated without a violent distention of the ligaments investing the articulation; and so long as the bone remains displaced, so long will the ligaments be distended beyond their natural state: from whence pain, and that in no small degree, always accompanies every recent luxation; and which pain generally ceases, or at least much abates, so soon as the bones are replaced. Hence therefore luxation is deservedly

^m Prorrhetic. Lib. II. cap. 11. Charter. Tom. VIII. pag. 819.

ⁿ De locis affectis, Lib. II. cap. 4. Charter. Tom. VII. pag. 404.

reckoned among the causes of pain § 224. numb. 3. If now we also consider, that the periosteum departs from the bones at their articulations, and continues on its course over the ligaments (see the commentary on § 343.) it will evidently appear, that the ligaments cannot be distracted without straining the incumbent periosteum in like manner, which being extremely sensible, may be another cause of pain. But when the dislocated bone has not been replaced for some time, the ligamentary fibres are so weakened by the continual distraction (see § 25. numb. 3.) that they more easily yield or elongate without danger of breaking; whence the pain is gradually diminished, and at length ceases. (see § 228. numb. 1.) But the circumjacent parts, which have been compressed and rubbed for so long a time by the dislocated head of the bone, become at length callous and insensible: We observed before, in speaking of the immobility, which follows luxations, that those are at length freed from their pain who have not had the dislocated bones reduced, and that they can also perform various motions of the joint easily enough. And Hippocrates^o, in treating on a luxation of the femur outwards, says, *Ubi caro, in quam articulus excessit, jam trita est, et tenax evasit, dolor tempore cessat. Quando autem dolore liberi sunt, ingredi sine baculo possunt, si alioquin velint, potestque affecto crure ferri corpus*; “The
“ fleshy parts, into which the head of the bone has
“ receded, become at length tough or callous by the
“ attrition, and the pain in time ceases. But when
“ the patients are free from pain, they are capable
“ of walking without a stick, if they so please, and
“ the weight of the body may be sustained by the
“ affected thigh.” For as Gorræus^p observes, the word *γνίξρον*, *tenax*, denotes in the solid parts a toughness or callosity; but in the fluids, a lentor or viscosity.

^o De Articulis, Charter. Tom. XII. pag. 411.

^p Definit. Med. pag. 133.

Watchings.] In the commentary on § 226. we reckoned *vigilia* or watchings among the effects of pain; and as it was before proved, that pain accompanies a luxation, it is evident that watchings ought to attend likewise, so long as the intensity of the pain continues.

Inflammation.] It will appear in the subsequent dissertation, that an inflammation attends whenever the impervious juices stagnate in the smaller vessels, and are urged on behind by the increased force of the circulation in a fever, by which the juices are pressed and ground together. Obstruction therefore supposes a quicker circulation of the humours. But in the commentary on § 112. it was demonstrated, that any force, which compresses or elongates the flexible vessels, diminishes their capacity, and may therefore be the cause of obstruction. But in a luxation the ligaments, tendons, and muscles, attached to the bones, are elongated: the dislocated bones, compress the adjacent soft parts, and from both these an obstruction may follow as the effect of a luxation. But a fever is reckoned among the effects of pain, (on § 226.) from whence it is evident that those two causes attend in luxations, which are sufficient to produce inflammation; namely obstruction, and a swifter motion of the blood arising from the fever and pain which accompany every luxation. But how violent the fever and pains are, which follow from luxations, is taught in several places by Hippocrates^p; for says he, *Humeri osse in cubiti articulo versus priorem partem luxato, nisi statim reponatur, graves et vehementes inflammationes sequuntur. Si vero versus posteriorem partem eruperit, maximum dolorem movet, et validissimas febres continuas, cum meracæ bilis excretionē, et paucis diebus lethales, excitat*; “ The os humeri being luxated for-
“ wards at its articulation with the cubitus, is follow-
“ ed with most violent and intense inflammations, if

^p Hippocrat. de fracturis, in fine libri. Charter. Tom. XII. pag. 266, 267.

“ it is not immediately reduced ; but when it is dis-
 “ located backwards, it occasions most severe pains
 “ and a violent fever, with a discharge of real bile,
 “ and proves fatal in a few days.” And the same he
 affirms, in treating on a luxation of the cubitus, in
 his book of the articulations ^r. And in another place,
 treating on a luxation of the jaw, he observes ^s, that
 it ought to be reduced with the utmost expedition ;
 for if it be not replaced, the patient’s life will be in
 danger from the continual fever : and he then adds,
 that these patients usually void pure bile in small
 quantities by stool, and if they vomit, they bring up
 the like humour.

[Œdema.] It was said in the commentary on § 112.
 numb. 1. that by this name even all preternatural tu-
 mours were called formerly ; but that afterwards it
 was restrained to those tumours only, which are soft,
 indolent, and yield to the pressure of the fingers.
 Such a kind of tumour is generally seated in the cel-
 lular membrane only, from an accumulation of the
 lymph stagnating in the cells of that membrane. But
 luxations are generally accompanied with this tumour,
 when the dislocated bone compresses the larger veins ;
 for thus the motion of the venal juices is impeded.
 so that the thin dew exhaled by the arteries into the
 cavities of the cellular membrane, cannot be duly ab-
 sorbed by the veins, whence being accumulated and
 stagnant, it is converted into water or ichor, as it is
 termed by Hippocrates.

[Anchylosis.] Celsus ^t tells us, that joints contracted
 with a recent cicatrix or callus were by the Greeks
 termed *ἀγκύλας* : but that a stiffness or immobility of a
 joint was also called *ἀγκύλας* and *ἀγκυλώσεις*, we are
 told by Ægineta ^u ; and that the cause was an infarction
 of the humours or a contraction of some of the liga-
 ments. Anchylosis therefore denotes an inflexibility

^r Hippocrat. de fracturis, in fine libri. Charter. Tom. XII. pag.
 331. ^s Ibid. pag. 340. ^t Lib. V. cap. 18. n^o 28.
 pag. 257. ^u Lib. IV. cap. 55. pag. 70. versa.

of a joint, which is frequently accompanied with a preternatural tumour. But for the joints to continue moveable, it is necessary for the heads of the bones to retain their proper figure and connection where they are articulated together, and to have their extremities evenly covered with a very smooth cartilage, lubricated with the proper liniment; and lastly, the ligaments themselves, which encompass the joint, must have a due degree of flexibility. But by luxations all these requisites are sometimes either destroyed or perverted: for the ligaments, being broke or violently distracted by the dislocation of the bone, become inflamed; as they also may from that force which is required to extend the bones and reduce them. But this inflammation may terminate either in a suppuration or a gangrene; whence the ligaments will afterwards remain rigid and contracted. Also this disorder of the ligaments will impair the secretion of the lubricating mucilage of the joint, which will be less than usual; whence again the motion of the joint will be impeded. While the ligaments are inflamed, most severe pains will arise from the least motion of the joint, which being therefore kept at rest, the liniment of the joint will not be sufficiently attenuated and absorbed; this therefore being accumulated, and deprived of its more thin and fluid parts, will at length concrete into an irresolvable mass, which will totally destroy the motion of the joint. If again the surface of the cartilage is wounded or abraded either in the dislocation or reduction of the head of the bone, or is some other way injured, this may be another cause of an ankylosis.

Convulsion.] The most acute pain, disturbing the whole common sensory, is frequently attended with convulsions: as was said before in § 226. and from hence a convulsion may follow a luxation. But besides this, a luxation is often accompanied with a considerable distortion of the muscles, and distraction of the tendons, which alone may be sufficient to produce

a convulsion. For we know by daily experience, what a severe pain and contraction of a muscle follows, commonly called the cramp, when any of the tendons of the muscles moving the fingers or toes are displaced. Hippocrates^w observes, that in a luxation of the bones of the leg, accompanied with a wound, if the heads of the bones next the foot are perfectly dislocated either outward or inward, they ought not to be reduced; for if they are reduced, the patient survives but a few days, and expires with convulsions. The same bad consequence is to be expected, he says^x, if the bones of the cubitus are so dislocated at the wrist, that they burst out through a wound: and he then adds^y, that if a convulsion follows the reduction of the bones, they ought speedily to be displaced again, and the parts must be afterwards fomented at times.

A withering.] When the larger arteries or nerves tending to any part, are from some cause obstructed, so that they cannot properly distribute their respective juices necessary for the life and nutrition of the parts, a true marasmus or wasting of those parts thence follows; since all the vessels are contracted and collapsed, from their present juices being dissipated, without any fresh supplies. A surprizing instance of such a withering is related in the commentary on § 161. where the axillary artery being totally divided, the whole arm afterwards dried up like a mummy. When therefore, for instance, the head of the os humeri is so prolapsed as to compress those large vessels in the axilla for a considerable time, it is evident that the like accident may be reasonably expected.

But Hippocrates^z has also remarked another cause of this withering: namely, when the dislocated bones have not been reduced. For, in treating of a luxation of the

^w De Articulis, Charter. Tom. XII. pag. 435.

443.
tibus.

^y Ibid. pag. 445.

^x Ibid. pag.
^z Ibid. pag. 203. & sequen-

femur, he says, that if this happens to those who are not yet grown to their full stature, and no reduction has been made, the thigh, leg, and foot is by that means rendered shorter; *neque enim ossa similiter in longitudinem augentur, sed breviora fiunt, femur præsertim. Crus item univèrsùm sine carne et musculis fit, et effœminatum et tenuius; partim quod articulus suo loco motus sit, partim quod nequeat suo munere fungi, quia non secundum naturam disponitur. Nam usus aliquis id, quod valde effœminatum est, confirmat; solvit etiam aliquid ex eo, quod augeri membrum in longitudinem prohibet. Potissimum autem læduntur, quibuscumque, dum in utero sunt, hic articulus elabitur; deinde quibus id accidit, dum in ætate sunt admodum tenera; minime quum jam robusti sunt;* “ for then the bones are not
 “ equally augmented in their length, but they, and
 “ especially the femur, become shorter. The whole
 “ leg also becomes feeble, slender, and almost with-
 “ out flesh or muscles; partly because the limb is
 “ dislocated, and partly because its functions are dis-
 “ turbed or abolished, from its vessels being not na-
 “ turally disposed. For the use of any limb that is
 “ feeble corroborates it; but every thing which pre-
 “ vents the growth or elongation of the limb, causes
 “ it also to decay or waste. But those have this in-
 “ jury in the most considerable degree, who have
 “ suffered a dislocation of the femur while in the
 “ uterus; and next, those to whom this has happen-
 “ ed when they were very young; but those are the
 “ least injured hereby, who are already strong and
 “ lusty.” But this withering, he observes^a, is chief-
 ly seated in the parts nearest to the dislocated joint; which he proves by the instance of those who have had a dislocation of the humerus from the birth, or at least before they have acquired their full growth; for in these the humerus is shorter, and the cubitus, with its adjoining hand, something less than the sound. He likewise adds, that they can generally perform

^a De Articulis, Charter. Tom. XII. pag. 408.

most kinds of work almost as well with the injured as with the sound limb: But when the head of the femur is dislocated inwards, he says, that the flesh is wasted the more, because they cannot use the limb. Hence that withering which follows the dislocation of a joint, which has not been reduced, cannot be always ascribed to the compression of the larger vessels, but it often results likewise from the defect of the muscular motion in the limb thus injured: and therefore Hippocrates ^b remarks, that when the femur is dislocated outwards in adults, and has not been reduced, the bulk or fleshyness of the parts is not so much diminished, because the limb does not lose its motions or use. For the fleshy parts, amongst which the head of the bone is protruded, become at length tough and firm by attrition, so that the patient can stand or walk on it without a stick. But after this, Hippocrates ^c deduces a general axiom from these observations, and says: *Quæcumque in corpore ad aliquem usum facta sunt; si quis moderate utatur, exerceatque in eo laboris genere, cui singula assueverunt; hoc pacto bene valent, augentur, et ad bonam senectutem deducuntur. Si in usu non sint, sed otiosa maneant, morbosiora fiunt, non augentur, et brevi senescunt: id præcipue accidit nervis atque articulis, nisi quis illis utatur;*

“ Every part of the body made for some action, being moderately used, and exercised in that sort of work to which each part is accustomed, does by that means become healthy, increase in bulk, and conduce to a good old age: But if they remain idle, and without exercise, they become more diseased, do not grow lusty, and bring age on apace; and this holds true principally in the ligaments and joints, unless a person uses them.” But what a considerable effect exercise has, in restoring from the aliments those parts which are continually wasted by the actions of a living and healthy body, has been al-

^b De Articulis, Charter. Tom. XII. pag. 411.
pag. 42.

^c Ibid.
ready

ready demonstrated in the commentary on § 25. numb. 2. and § 28. numb. 2. If again we also consider, that the tendons, muscles, ligaments, *etc.* contract or shorten, and at length become rigid if they are not moved; and that the vessels of our bodies collapse, and close by their own contractile power, from a diminution of their distending causes; it will be from thence evident why the parts shrink or waste, after the motion of a limb is impeded by a luxation.

All that Hippocrates has said in different places concerning this withering of the parts, is collected together by Celsus^d, and expressed in a manner no less concise than elegant: *Ac, quibus in pueritia exciderunt (articuli) neque repositi sunt, minus quam ceteri crescunt: omniumque, quæ loco suo non sunt, caro emacrescit, magisque in proximo loco, quam in ulteriore; ut puta, si humerus loco suo non est, major in eo ipso fit macies, quam in brachio; major in hoc, quam in manu. Tum pro sedibus, et pro casibus, qui inciderunt, aut major aut minor usus ejus membri relinquitur: quoque in eo plus usus superest, eo minus id extenuatur;* “As for
 “limbs which have been dislocated in childhood, and
 “which have not been replaced, they grow less than
 “the rest; for the flesh or muscles of every distorted
 “limb consumes or falls away, and this more in the
 “parts near the luxation than in those which are
 “more remote: As for instance, if the humerus is
 “displaced, there happens a greater wasting in that
 “than in the fore-arm, and a still greater in the fore-
 “arm than in the hand. Add to this, that more or
 “less of the action of the limb remains, according
 “to the different seats and causes of the luxation;
 “and likewise, the more the action of the limb re-
 “mains, the less is it extenuated or wasted.”

The observations of the most skilful surgeons likewise confirm this doctrine. A youth sitting down in a meadow, was drawn by the leg by a playful girl,

^d Lib. VIII. cap. 11. pag. 544.

whereupon a pain ensued in the articulation of the femur, which was yet but slight. A very skilful surgeon being called, upon the strictest examination could find no signs of a luxation, but imagined the pain arose from the distraction of the muscles and ligaments investing the articulation; and therefore he only applied some linen cloths dipped in spirit of wine to the affected parts, and retained them by a suitable bandage. The careful mother, who expected to have seen a much more formidable apparatus used, called in a country fellow, who was by the ignorant common people believed to be a great master in reducing luxations. The rustic so forcibly extended the falsely supposed dislocated limb that he actually displaced the head of the femur inwards from its cavity; as it evidently appeared, after the severe pain, tumour, and inflammation of the parts were removed by proper remedies. For the injured leg was two inches longer than the sound one. As the patient was not yet arrived to his full growth, the surgeon predicted that there would be a deficiency in the future growth of the injured limb in proportion to that of the rest of the body: the truth of which assertion was afterwards proved by the event; for when the whole body was grown four inches higher, the injured leg was about two inches shorter than the sound, notwithstanding they were at the reduction both of the same length^e.

Death of the part or of the whole body.] Among the effects or consequences of pain, we reckoned a gangrene § 226. which is that state of the soft parts in which they tend to death or mortification, by being deprived of their vital influx of blood, by the arteries and reflux of the veins. The same disaster also frequently happens from a violent inflammation, which is so general an attendant on luxations. When the bones of the leg are dislocated at the foot with a wound, Hippocrates^f observes, that to attempt a re-

^e De la Motte *Traité complet. de Chirurgie*, Tom. IV. pag. 367—375.

^f De Articulis, *Charter*. Tom. XII pag. 437.

duction would cause a gangrene to invade the leg and foot. If therefore the larger vessels are so compressed or injured by the luxation, as to intercept the vital influx and reflux of their juices, a death or mortification of the part is at hand; as it also is when the reduction of the bones is attempted while the violent inflammation continues. For the strong extension and rough handling which are required in the reduction, often cause the inflammation to turn speedily to a gangrene. An unfortunate case of this nature is related by the sagacious author^s lately cited. An unskilful person attempted to reduce the elbow, which was dislocated in a servant man the day before, and this notwithstanding a violent inflammation occupied the adjacent parts of the articulation; for he had called into his assistance two strong men, who most violently extended the part. By the next day a gangrene had extended itself up to the middle of the arm, and the patient's life could be saved no other way than by amputating the limb. But that death itself of the whole body is likewise often the consequence, may sufficiently appear from what has been already said in the commentary on this aphorism: for we observed that a luxation of the jaw is often attended with violent convulsions and death; and Hippocrates observed, that violent fevers arise after a dislocation of the cubitus. The same he also observes, when the larger bones are so dislocated that they start thro' a wound; for then convulsions and death are at hand if they are replaced; and if they are let alone, even then life is often in danger.

S E C T. CCCLXV.

FROM a knowledge of all which symptoms, we are furnished with the demonstrative signs of a present luxation.

* De la Motte, &c. Tom. IV. pag. 359.

To be satisfied of the luxation of any joint, the first enquiry must be whether a cause sufficiently violent has preceded, by the force of which the head of the bone might be displaced: and whether this cause was external (§ 361.) or internal, residing in the cavity of the articulation (§ 362.) And then enquiry must be made whether the articulating ligaments have been overstrained or broke by a too violent external force preceding; or whether the ligaments are so relaxed from any cause, that they do not firmly retain the joint which they invest, of which we spoke in § 363. After it appears from hence, that there is just ground to suspect a luxation, we must then diligently enquire after those signs which demonstrate that a luxation is present. And the chief of these are a preternatural tumour from the head of the bone being displaced into some other part, with an unusual cavity in the place where the head of the bone was naturally seated. But to make the diagnosis certain, both these signs ought to attend; for either of them alone is often found fallacious. We gave an instance of such an error in the commentary on the preceding aphorism, committed on no less a person than Galen himself, whose humerus was mistakenly supposed to be luxated, from the appearance of a preternatural cavity made by the distortion of the acromion, without any unusual tumour appearing in the adjacent parts. And thus I saw an inflammatory tumour formed in the groin by a fall, mistaken for a luxation of the femur; when at the same time the girl being of a lean habit, one might easily perceive by the touch that the articulation was right, and that there was no preternatural cavity. It is a strong confirmation of the diagnosis, when the motion of the limb, which depends on the natural conformation of the joint, is totally destroyed, or else very much depraved. And if at the same time, by comparing the injured limb with that which is sound, there appears a considerable difference

in their figure and length, there seems then to be no room to doubt of a luxation.

The diagnosis of a luxation is however sometimes very difficult : for if the inflammation arising from a violent contusion, distortion, *etc.* has caused a considerable tumour to be formed round the joint, it will be neither easy to perceive the protuberance nor the preternatural cavity which is there formed ; while at the same time all the motions of the joint are prevented by the intense pain. In such a case, therefore, one ought chiefly to consider whether the antecedent cause was such, as that one might from thence reasonably expect a luxation. Nor will it be of any bad consequence to suspend our judgment in such a doubtful case ; because the violence of the inflammation will render it dangerous to reduce the luxation : therefore that ought to be first removed by proper remedies, and then the affected parts may be more distinctly examined.

But how much caution is often required in distinguishing luxation, is evident from the case which Galen^a relates. A man dislocated his arm in the field of exercise : the physician upon comparing the injured limb with that which was sound, could perceive no difference ; whence he too hastily concluded that the part was injured with a contusion, but that the articulation was sound. He therefore ordered the patient to the bath, and after covering the part with woollen cloths dipped in wax and oil, to compose himself to rest. But as by these means the pain did not abate all night, on the day following, the physician full of indignation (because others more unskilful than himself were consulted) readily confirmed and persisted in the diagnosis which he made the day before, and said, that the humerus was inflamed by the pain, and that therefore he would have the same means continued. But on the third day, the pain

^a In Commentario primo in librum Hippocrat. de Officina Medici. Charter. Tom. XII. pag. 6.

being nothing abated, and Galen being called into consultation, he found indeed, that the affected shoulder had no preternatural cavity in the place of the articulation, but that it was rather more tumid than the other shoulder; but thrusting his fingers under the axilla, he immediately perceived the head of the humerus was lodged there, and therefore determined there was a luxation. It was the comparifon of the injured limb with that which was found, which deceived the first physician; whereas upon Galen's enquiry, the patient owned, that by a fall from a chariot he had formerly broke off the acromion of the other shoulder, which the physician supposed to be found and natural, though it had thence an apparent excavation; so that by comparing the two shoulders together, the same cavities appearing in each, led the first physician into an error.

After the existence of the luxation is ascertained, it is farther required in the diagnosis to determine towards which part the bone is prolapsed, whether inwards, outwards, upwards, downwards, *etc.* for many things necessary towards the prognosis and cure depend on this determination. Much light will be afforded in this affair from the anatomical knowledge of the various connections and articulations of the bones, with a consideration of their movements resulting from the particular disposition of each joint. But the particular quarter towards which the head of the bone is displaced, may be also determined from the same consideration of their motions; and therefore Hippocrates, and all the best proficients after him, have very diligently collected all the signs by which one may distinguish the different modes of dislocation in the same joint. Thus, for instance, he observes, that if the injured arm cannot be extended, the cubitus is dislocated backwards; and, on the contrary, that when the joint is luxated forward, the cubitus cannot be inflected ^b: and in treating on the se-

^b Hippocrat. de Articulis, Charter. Tom. XII. pag. 331.

veral luxations of the femur^c, he accurately remarks the signs proper to each, *etc.* which seem unnecessary to be here repeated.

S E C T. CCCLXVI.

AND from having considered the size, figure and situation of the accident, with the intercepted or compressed parts; the age of the dislocation, and its degree of concretion; with the pain, inflammation, convulsion, or other symptoms in the circumvesting parts, which are of a more or less slender or gross texture; also the ligaments themselves, being either broke or elongated, with their annexed muscles, &c. From all these is deduced a prognosis indicating whether the cure will be compleat or defective; speedy or slow; and easy or difficult.

After the luxation is apparently demonstrated by the diagnostic signs, every circumstance mentioned in this aphorism ought then to be duly considered, in order to form a certain prognosis of the bad consequences that may be feared from the known luxation, or from that force which will be necessary to reduce the dislocated bones. For all these ought to be intimated, at least to the patient's friends, if not to himself, lest the supervening accidents, which are by no means avoidable, should be imputed rather to ignorance or neglect in the surgeon, than to the violence of the disorder. But the principal enquiry in the prognosis is, whether such a cure may be expected, that the limb will afterwards recover all its usual motions; or whether only some of the usual motions of the dislocated limb will remain, and those not absolutely the same as they were before the luxation. For thus is distinguished whether the cure will be

^c Hippoc. de Articulis, Charter. Tom. XII. pag. 398. & sequent.
compleat

complete or defective. It ought also to be further determined, whether the cure may be completed in a short space of time, or whether a longer interval will be required to restore the limb to its due strength. For if, for example, the ligaments have been violently strained, or otherwise relaxed, so as to lose their strength before the accident, a speedy cure cannot be expected. But the cure may be said to be easy when only a slight extension is necessary to reduce the luxation, which is not attended with any very bad symptoms. But, in the contrary case, one may justly foresee, that the cure will be attended with difficulty when it requires a violent extension, and most or all of the assistances of art. “It is the business of a quack “to magnify a slight case, that his performance may “appear the more considerable,” says Celsus^a. *Histrionis quidem est, parvam rem attollere, quo plus præstitisse videatur*; but it can never be amiss to represent the prognosis rather on the more difficult side; for if the ill consequence supervenes, they will reflect that it was predicted to them: but if every thing succeeds happily, the happy event will merit praise to the surgeon. But what consequences are to be feared, will be evident from the following considerations.

Size or magnitude.] The magnitude of a luxation is measured by the distance which is intercepted betwixt the head of the bone, and the cavity from whence it was displaced. But it is evident, that the farther a bone has receded from its cavity, in which it naturally moved, the more will the investing ligaments be distended, even sometimes to a rupture; and the greater distraction also will the adjacent tendons and muscles suffer, whence extreme pain, inflammation, *etc.* follow. It is also equally evident, that a luxation may be the more easily reduced, as the head of the bone is nearer to the cavity from whence it was displaced. Whence Celsus observes^b,

^a A. C. Celsi Medic. Lib. V. cap. 26. pag. 283.

^b Lib. VIII. cap. 15. pag. 549.

it will be much more easy to reduce the humerus when it is dislocated forwards, than when its head is prolapsed into the axilla.

Figure.] It was said before (on § 364.) that a luxation is attended with an alteration of the figure of the limb; therefore the greater this alteration, which is observed by comparing the sound and injured limb together, so much the greater change is there in the situation of all the circumjacent parts, and so much greater is their extension or distortion; all which will apparently augment the difficulty of the cure. But the figure of the dislocated joint itself may cause a great deal of difference in this respect; as for instance in a dislocation of the humerus, if the head of the bone is lodged before its proper cavity, by relaxing the parts after a due extension is made, the bone easily slips into its place. But in the os femoris the case is very different. For the head of that bone with its slender neck forms an obtuse angle with the rest of the descending body of the bone; whence it will be here necessary to use another artifice. For though by a forcible extension the displaced head of the bone may be brought over against its proper cavity, yet it may very easily slip upwards and pass over its laterally placed cavity: whence Hippocrates^c, treating of the reduction of the os femoris when dislocated inwards, so disposes the whole apparatus, as that the surgeon's hand may press laterally and urge the bone into its place when the head comes over-against its cavity.

Situation.] If we consider those wise observations which Hippocrates^d has made concerning the different directions of a luxated femur, it will sufficiently demonstrate what a considerable difference may arise in the effects of a luxation from this cause only. For if the femur is dislocated inwards, and cannot be replaced, as it frequently happens,) then the muscles or flesh, which encompass the dislocated bone, fall away,

^c De Articulis, Charter. Tom. XII. pag. 455.

^d Ibid. pag. 399. & sequentibus.

and the action of the limb will be much vitiated. But the ill consequence will be much less if the head of the femur is dislocated outwards: and therefore Hippocrates^e makes this general inference; *Circa coxas magna differentia est, versus interiora aut versus exteriora, luxatum esse: circa genua quidem differt, sed minus. Modus autem claudicationis utrisque proprius est: nam quibus in exteriorem partem procidit, vari magis sunt; minus autem recti stant illis, quibus in interiorem partem luxatur. Similiter autem & si circa talum luxatio facta fuerit; si enim versus exteriorem partem, vari quidem sunt, sed stare queunt. Si versus interiorem partem exciderit, valgi quidem sunt, minus vero stare possunt;* “ With respect to the hip or joint of the femur
 “ there is a great deal of difference, according as it is
 “ luxated either inwards or outwards; and with re-
 “ spect to that of the knee there is also a difference,
 “ but less than in the former. But there is a particu-
 “ lar mode of halting proper to each of these: for
 “ those who have the femur dislocated outwards, have
 “ their leg turned rather inwards; but those do not
 “ stand so upright, who have the femur luxated in-
 “ wards. The same likewise holds in a luxation of
 “ the ankle; for if the foot be dislocated outward,
 “ they can stand, and are termed *vari*: if it be dislo-
 “ cated inwards, they cannot so well stand, and they
 “ become *valgi*.”

The parts compressed or intercepted.] What sad disorders may follow, when dislocated bones compress the adjacent parts, is no where more evident than in a luxation of the vertebræ of the spine; for then the spinal medulla included within their cavity is compressed, confused, and sometimes wounded. And here the consequences are always more fatal, as the luxation is seated higher up towards the head: and therefore a luxation of the head itself, (by the slipping back of its glenoide processes, by which it is connected to the uppermost of the vertebræ,) is by Cel-

^e De Articulis, Charter. Tom. XII. pag. 406.

fus ^f justly pronounced fatal. *Nervi sub occipitio extenduntur, & mentum pectori agglutinator, neque bibere is, neque loqui potest: interdum sine voluntate semen emittit, quibus celerrime mors supervenit;* “The nerves
 “below the occiput are extended or obstructed, the
 “chin is pressed close to the breast, nor can the pa-
 “tient either drink or speak; and sometimes there
 “is an involuntary discharge of the semen, which
 “symptoms are soon followed with death.” And he
 afterwards observes ^g, that those are much in the same
 condition who have a luxation of the vertebræ of the
 spine, but that they do not die so soon as one who
 has luxated the head, but yet that they die within
 three days time. He also there enumerates those ve-
 ry bad consequences which follow a perfect luxation
 of the vertebræ; that is, when they are wholly dis-
 placed: for then he says, the spinal medulla, its
 membranes and nerves, must of necessity be ruptured.
 But if the vertebræ are only distorted a little out-
 wards, he proposes a method of cure out of Hippo-
 crates. See also upon this subject what has been said
 in the commentary on § 364. concerning the numb-
 ness and palsy of the parts below the dislocated joint.
 But if in reducing the dislocation the parts of a nerve,
 tendon, muscle, blood-vessel, or the like should be
 unfortunately intercepted betwixt the bones, it is evi-
 dent that the most excruciating pains, convulsions, &c.
 may thence follow. But such an interception cannot
 easily happen, if a due extension of the parts precedes
 the reduction of the luxation.

Age or continuance.] Hippocrates ^h lays it down
 as a general rule, that luxations ought to be reduced
 immediately, or at least as soon as possible. For he
 observes, that the reduction may be more easily made
 before the part begins to swell, and the patient will
 then likewise suffer less pain. And the most celebra-
 ted surgeons, who always provide their whole appa-

^f Lib. VIII. cap. 13. pag. 546.

^g Ibid. cap. 14. pag. 547.

^h De Articulis circa finem. Charter. Tom. XII. pag. 466.

ratus of dressings in order, before they reduce a fracture, do nevertheless immediately reduce a luxation, and then provide the necessary bandages and other things proper for retaining the reduced bonesⁱ. Even if a fracture should unluckily accompany a dislocation, the latter is always reduced before the fracture is touched; partly for the foregoing reasons, and partly because the reduced fragments might be displaced again by the force required to reduce the luxation^k. But if the joint has continued dislocated for some time, the parts affected soon swell, inflame, and become extremely painful; whence there might be danger of inducing a gangrene by a rough handling. Also the ligaments, which have been long distracted, lose their strength; whence the reduced joint may be very easily dislocated again. And the considerable glands, which are seated in the larger articulations, being set free from the compressure by the head of the bone, or else inflamed, may swell so as to greatly diminish the cavity of the joint; whence the reduction will become difficult, and the retention still more difficult. Add to this, that the mucilage or liniment lubricating the joint, and which used to be attenuated and dispersed by its constant motion, will now be accumulated, and often reduced into so thick a mass, that it can afterwards be dissolved by no art, but fills up the cavity of the joint, so that there is no longer any room for receiving the head of the bone. If again it be considered that an inflammation often follows, unless the luxation is speedily replaced, which may cause a deep suppuration, (as Hippocrates^l observes in treating on a luxation of the thigh,) the reason will be very evident why many bad consequences may be foreseen in the prognosis, if the dislocation continues any considerable time before its reduction is attempted.

ⁱ De la Motte Traité complet de Chirurgie, Tom. IV. pag. 358.

^k Ibid. pag. 393.

^l De Articulis, Charter. Tom. XII. pag. 411.

A concretion.] It is well known that all parts of the body contiguous to each other are prevented from growing together by the intervention of a thin vapour like dew, which replenishes all the larger and smaller cavities of the body. But when this dew is absent, the parts which were before separated soon grow to each other. Now when the parts are inflamed, the great distention of the larger vessels compresses these smaller exhaling ones: whence follows that dryness of the parts in inflammations, which causes them readily to cohere and grow together. Thus the lungs are almost constantly found adhering to the pleura after a pleurisy or peripneumony. Therefore the head of the bone now displaced, and deprived of its natural liniment, will readily cohere and grow to the adjacent parts, which are also at the same time inflamed by the violent distraction or compression which they endure. From whence it is evident that the reduction must be then impracticable. But we have already seen, that the cavity of the joint likewise may be soon filled by a luxuriancy of the glands or an inspissation of the mucilage. And perhaps too the bony cavity itself may shrink and grow gradually less from the absence of the dislocated head of the bone; for we see, that after the evulsion of a tooth, the sides of the jaw composing the alveoli do by degrees close and meet together, till they are at length so united, that no mark of the socket of the tooth remains.

Pain.] A recent luxation is always accompanied with pain, as we said before in the commentary on § 364. But if this pain is extremely excruciating, the worst events may justly be feared: because it denotes that the aching parts are in such a state as tends to a total dissolution of their continuity, (see § 220.) Also the worst consequences of extreme pain, enumerated in § 266, may be thence expected; more especially as the reduction of the luxated bones requires a forcible extension of the parts already full of

pain; whence there may be danger of convulsions, delirium, a gangrene, &c.

Inflammation.] How an inflammation comes to be a consequence of a luxation has been explained in the commentary on § 364. For it is almost a constant attendant, unless the dislocation was speedily reduced. But when a violent inflammation has invaded the dislocated part, it is in the utmost danger. For unless the luxation is reduced at first, it will be very difficult to do it afterwards: and if the parts are roughly handled during the inflammation, a gangrene may follow in a little time. But in such a case, of two evils the least is to be chose; and therefore it will be best to relinquish the reduction until the inflammation is removed or abated by proper remedies. This is also the opinion of Hippocrates^m, who, in treating on the most dangerous luxations, says, *Eodem die restituendæ sunt, vel sequenti; tertio vero aut quarto minime. Ubi enim usque ad quartum diem duraverint, maxime recrudescere videmus. Ubi ergo non protinus recondantur, his diebus supersedendum est. Contineri enim solet, quod intra decem dies conditur;* “ That they are
 “ to be reduced the same day or the day after; but
 “ by no means on the third or fourth day. For
 “ when they have been neglected until the fourth
 “ day, we have observed the worst symptoms attend.
 “ If therefore they are not immediately reduced,
 “ those days are to be passed over in expectation; for
 “ it usually happens that they may be reduced within
 “ ten days.” And in another placeⁿ, speaking of a luxation of the cubitus, he lays it down as a general rule: *quod nullum articulum, dum febris adest, in suam sedem reducere conveniat, & omnium minime cubitum;* “ That it is not proper to reduce any luxation while
 “ the fever continues, and above all not to reduce
 “ that of the cubitus.” But a fever is both a sign and attendant of a violent inflammation, which ac-

^m De Articulis, Charter. Tom. XII. pag. 445.

ⁿ De Fracturis, Charter. Tom. XII. pag. 267.

companies a luxation. The same is also the advice of Celsus °, when he says, *Quidquid autem loco suo motum est, ante inflammationem reponendum est. Si illa occupavit, dum conquiescat, laceffendum non est: ubi finita est, tentandum est in his membris, quæ id patiuntur*; “ But
 “ whatever is dislocated ought to be replaced before
 “ the inflammation appears: but when that has inva-
 “ ded the parts, it ought not to be molested till it is
 “ appeased; and when it is over, trial may be made
 “ what can be done with the dislocated limb.” In the commentary on § 364, we related a case, in which a very bad gangrene followed the reduction of the cubitus, while the parts were in a state of inflammation. In such a case therefore the reduction should be postponed, and the patient or his friends acquainted with the danger that is threatned by such an attempt; but that the cure may be difficult afterwards, and often not compleat: and this to prevent any reflection on the physician or surgeon. For though a luxation ought to be reduced as soon as possible, when nothing forbids; yet observations teach us, that we ought not wholly to despair, when the joint has been a long time displaced. For a luxation of the humerus, accompanied with a violent inflammation, could not be reduced till after the expiration of two months time; but yet a compleat cure was made of so inveterate a malady^p. But what obstinate symptoms follow the extension of a joint while it is inflamed, is demonitratred in several instances by Hildanus^q.

Convulsion and other bad symptoms.] That a convulsion sometimes follows a luxation was said in the commentary on § 364. and this especially from extreme pain and a violent extension or distortion of the tendons or muscles. But of what consequence a convulsion may be, we declared in the commentary on § 233. But it is evident that no attempt can be

° Lib. VIII. cap. 11. pag. 544.

^p La Motte Traité complet de Chirurg. Tom. IV. pag. 354.

^q Centur. 2. Observ. 90. pag. 168.

made to reduce a luxation during convulsions, because the pain would be then violently increased as well as the distraction of all the parts; and therefore the convulsive causes would be thence increased. But the antient physicians were so fearful of convulsions in these cases, that Hippocrates^r, and even Celsus^s after him, even says, *si quoque, reposito osse, nervi distenduntur, rursus id protinus expellendum est*; “That if a
“convulsion follows after the bone is reduced, it
“must be immediately displaced again.” And Hippocrates in another place^t seems for this reason to pronounce a luxation of the jaw fatal in those who are subject to cramps, and to be convulsed backwards: for then this luxation cannot be reduced because of the cramp; and if it is not reduced life is in danger, as was said in the commentary on § 364.

If now a violent fever, faintings, hiccups, &c. attend over and above the symptoms now enumerated, it is evident, that to reduce a luxation cannot be safely attempted, and that therefore the prognosis must be hard.

The investing parts being thinner or thicker.] It was said before from Hippocrates in the commentary on § 363. that fleshy joints do not so easily slip out, but then they are more difficult to replace when out. Therefore the luxations of those larger joints are the most dangerous, which are encompassed with large muscles, and confined by strong ligaments. For such joints cannot be dislocated but by the greatest violence; whence the most dangerous symptoms often follow. Hence it is that Celsus^u, treating of those luxations which are accompanied with a wound, says, *Hic vero & ingens periculum est, & eo gravius, quo majus membrum est, quove validioribus nervis aut musculis continetur. Ideoque ab humeris, femoribusque,*

• De Articulis, Charter. Tom. XII. pag. 445.

• Lib. VIII. cap. 25. pag. 557.

• Coac. Prænot. n°. 361. Charter. Tom. VIII. pag. 87z.

• Lib. VIII. cap. 25. pag. 557.

metus mortis est; ac si reposita sunt ossa, spes nulla est; non repositis tamen, nonnullum periculum est; “ But
 “ here the danger is great, and the more as the limb
 “ is larger, and confined by stronger ligaments and
 “ muscles. And therefore in such luxations of the
 “ humerus or femur the patient’s life is in danger;
 “ insomuch that if the bones are replaced there are
 “ no hopes; and if they are not replaced there is also
 “ some danger.” And in treating on a luxation of
 the thigh, he says ^w, *Magnum autem femori periculum*
est, ne vel difficulter reponatur, vel repositum rursus
excidat, &c. cum ibi valentissimi nervi musculique sint, si
suum robur habent, vix admittere ut reponantur; si non
habent, repositum non continere; “ But there is great
 “ danger in a luxation of the femur, because it is very
 “ difficult to reduce, or when it is reduced, it may be
 “ again displaced, &c. and as the tendons and muscles
 “ are here very strong, they scarce admit of being
 “ replaced, provided they have their due strength;
 “ and if they have not their due strength, the redu-
 “ ced bones cannot well be retained in their situa-
 “ tions.” From hence it is evident, that attention
 must be given to these particulars in forming a prognos-
 is.

A rupture or elongation of the ligaments.] If the confining ligaments of the joint have been so much stretched as to suffer the bone to slip out of its seat, they may be afterwards contracted and restored to their former strength, provided they are not broken; but if they have been quite broke, there is great danger lest the recent wounded lips should grow to the bones or to the adjacent parts, or lest the cicatrix of the late wound should render the ligaments less flexible; whence the easy motion of the joint would be afterwards impeded. Thus, for example, a luxation of the os femoris can scarcely be supposed to arise suddenly from some external violence without breaking the round ligament which arises out of the ace-

^w Lib. VIII. cap. 20. pag. 554.

tabulum, for certain it is, that a luxation may arise from a gradual elongation and weakness of the ligaments from some cause seated in the cavity of the joint itself. Hence the difficulty of cure in this case is evident, for it is very seldom that the contracted ends of the broken ligament grow together again; from hence again the reduced bone may be afterwards more easily displaced. But when the dislocated bones appear through a wound of the integuments, the case is then very difficult, especially if their ligaments are entirely divided, insomuch that Hippocrates^x despairs of a cure in such luxations: for he says, *Quibus autem cruris ossibus luxatis, & vulnus facientibus, penitus excidunt articuli, qui circa pedem sunt, sive in interiorum, sive in exteriorum partem, tales non sunt reponendi, sed sinendum est, ut ille medicus, cui hoc placet, reponat. Scire enim licet, quod moriatur, si repositi serventur, & paucorum dierum vita fiet. Pauci enim septimum diem excedunt. Convulsio enim occidit;* “ But in those luxations of the bones of the leg, in which the articulation is perfectly displaced, and accompanied with a wound near the foot, whether towards the internal or external ankle, these ought not to be reduced, but to be left to the care of the physician who attends; for it is to be observed, that the patient dies if the bones are replaced, or at most they survive but a few days, for not many of them exceed the seventh day, being taken off with convulsions.” He observes, that the only hope which then remains is, when the dislocated bones of the joint are not replaced, for then the patient may be preserved, though not without an unsightly lameness remaining during their life-time afterwards. He observes likewise, that there is the same danger when the bones of the arm are dislocated with a wound; and says, that these luxations are the worst when they happen in the bones of strong people; so that if the femur is dislocated at the knee, a reduction of it will

^x De Articulis, Charter. Tom. XII. pag. 435.

kill the patient sooner than in other cases; and if there is no reduction, the danger will be still more imminent than in other cases^y. He advises to attempt the cure of luxations only in the fingers and toes, when they perforate the skin with a wound; but even then not without great caution, because the bones afterwards suppurate, whence the physician might gain discredit; and therefore he ought not to be over-forward in attempting to reduce those luxations. But extraordinary events demonstrate, that we ought not always to despair in these cases, especially if such a luxation is accompanied with a rupture of the ligaments in the lower joints. A very active woman jumped down on her feet from an high tree, which occasioned a large ecchymosis in the left leg from the toes to the middle of the thigh; but the right leg, pitching only upon the ankle, was so twisted, that the os tibiæ started through the integuments to the length of three or four fingers breadth, and also ran into the earth; at the same time too the fibula was fractured at about the distance of two fingers breadth from the joint. The violent contusion and laceration of the parts occasioned the expert surgeons to conclude that the part must be amputated; but as the patient was in the flower of her age, of a strong and healthy habit, and the disorder seated towards the lower part of the limb, therefore a reduction of the fractured and dislocated bones was attempted: for there was a fair opportunity of waiting to see if there might be hopes of a cure, since the gangrene, which was here justly expected, very seldom comes on so fast, but that it may be afterwards successfully extirpated. But beyond all expectation the pains were mitigated, and convulsions prevented by using the best remedies; so that by an exfoliation of the divided parts of the tibia and fibula, which had been exposed to the common air, this woman happily escaped from so dangerous a malady, insomuch that she could afterwards walk, and perform

^y De Articulis, Charter. Tom. XII. pag. 444, 445, 446.

her wonted business, though with a stiffness remaining in the joint of the foot^z. It is yet sufficiently evident how difficult and dangerous luxations are, in which the ligaments are destroyed.

The annexed muscles.] For if very strong muscles are seated about the joint, it cannot be dislocated but by the most violent causes, from whence the muscles are often so much distracted, that they do not afterwards recover their pristine strength, or, at least, they receive it but very slowly; and therefore there will always remain a deficiency in the motion of the dislocated joint for the future. Thus, for instance, it is known from anatomy, that one of the tendons of the biceps muscle of the arm arises from the upper and outward part of the sinus in the scapula, into which the head of the os humeri is received, and passing through the ligamentary capsule, over the head of the bone, it proceeds to the sinus or groove in that bone, and from thence emerging, it then becomes a fleshy belly, and unites with the other head of the same muscle. If now the head of the humerus is dislocated forwards, it is very evident that this tendon of the biceps will suffer a great distention, whence the motion of the joint will perhaps remain for the future in some measure disturbed.

Having thus pointed out the principal sources from whence the prognosis of luxations may be deduced, it now remains for us to treat of their cure.

S E C T. CCCLXVII.

IN order to which is required, 1. a reduction of the dislocated bones, and 2. a retention of the replaced bones in their proper situations, in order to compleat the cure.

^z De la Motte Traité complet de Chirurgie, Tom. IV. pag. 435, &c.

If every thing be duly considered, and it appears that there are no symptoms which can render a reduction of the bones either useless or impossible, it must be then attempted. We observed before, that it was impracticable to reduce luxations which are of long standing, because generally the cavity of the joint is usually filled with concreted juices, or a luxuriance of the parts freed from the pressure of the dislocated bone. We also observed, that a cure could not be attempted, while the parts were invaded with inflammation, large tumour, or convulsions; as also when we perceive that these symptoms will soon after follow, for then prudence requires to defer the cure; in order to which, the two following particulars are necessary.

1. This is self evident.

2. The ligaments which connect the bones to each other, give the joints their chief strength, but no luxation can happen, without these ligaments are either broken, or so much elongated, that they suffer the head of the bone to be displaced. But it was said before, in the commentary on § 363. that a violent distention may so weaken the solid parts of the body, as to make them lose much of their strength, so that if the bones are replaced, the ligaments do not then acquire their former strength, and therefore easily permit the joint to be dislocated again, unless that is prevented by art. But how easily a joint may be again dislocated after a reduction has been made, we are taught by the case related by the surgeon which we have so often recommended. For he ^a ingenuously confesses, that he could neither prevent the elevation of the patient's arm, nor the dislocation of the bone the second time, when he attempted to reduce the luxated humerus; and yet he reduced the bone again so speedily, that neither the patient, nor the servants who assisted him, could perceive his error. The cure of a luxation

^a De la Motte Traité complet de Chirurgie, Tom. IV. pag. 347, there-

therefore requires a retention of the reduced bones in their proper situations, until the ligaments have recovered their due strength, so as to be able to perform their usual motions without danger of being dislocated again; for this is the main end of the cure. But the time required for the ligaments to recover their former strength again, is not very exactly limited by authors: in the mean time it is certain, that more or less time is required according to the different magnitude of the luxation, and of the joint, and according to the different temperature of the patient, and more or less urgency of the symptoms which accompany the luxation. The magnitude of the luxation is measured by the distance of the displaced bone from its cavity, as we observed before under the preceding aphorism; and it is very evident, that the ligaments must suffer a greater violence, in proportion as the head of the bone is farther displaced from its natural cavity: whence a longer time will also be necessary to compleat the cure. Add to this, that the greater or less weight which the limb is to sustain when in health, will also more or less protract the cure; thus a luxation of the femur and ankle, require a long time of rest, as Celsus ^b observes; but the joints of the fingers recover their strength in four days time, as Hippocrates ^c tells us. But what a difference, in this respect, is made by the different constitution of the patient, Celsus ^d again informs us, when he says: *Si corpus tenue, si humidum est, si nervi infirmi, expeditius os reponitur; sed & multo facilius excidit, & minus fideliter continetur. Quæ contraria his sunt, melius continent: sed id, quod expulsus est, difficulter admittunt;* “ If the body is thin and moist, “ and the ligaments are weak, the bone is more “ speedily reduced; but then it more easily slips out “ again, and cannot be so securely retained. Where- “ as in those patients who are of a contrary disposi-

^b Lib. VIII. cap. 20, & 22. pag. 555, 556.

^c De Articulis in fine. Charier. Tom. XII. pag. 467.

^d A. Corn. Cels. Med. Lib. VIII. cap. 11. pag. 544.

“ tion, the bones are more securely retained, but
 “ more difficultly reduced.” The like we also meet
 with in Hippocrates^e. It is evident enough, that the
 number and violence of the symptoms often prolong
 the cure; but yet Hippocrates observes, that a slight
 inflammation following the reduction, is rather ser-
 viceable than prejudicial; since the pain then prevents
 the use of the limb, and the ligaments being kept in
 a state of tension by the inflammation, retain the bone
 more securely in its cavity. Thus he says^f, in the
 place before cited, which we likewise mentioned upon
 another occasion § 224. numb. 3. *Qui reposito articulo,*
partibus ambientibus nulla inflammatione affectis, protin-
us humero uti sine dolore possunt, hi nulla cura sibi opus
esse arbitrantur. Sed Medici officium est præ sagire con-
tra illorum opinionem, si quidem his rursus prolabitur
magis, quam quorum nervi inflammatione tentantur;
 “ Those who have the joint reduced, without any in-
 “ flammation of the circumjacent parts, are capable
 “ of using their arm immediately without pain, and
 “ think that they have no occasion for any farther as-
 “ sistance: but it is the business of the physician to
 “ declare against their opinion, in as much as they
 “ will be more liable to a second dislocation than those
 “ whose ligaments are inflamed.” It can never be
 hurtful to secure the parts of the dislocated limb, so
 that it may not be moved for a considerable time, pro-
 vided that care is also taken not to let the joint grow
 stiff by too long a rest.

At the same time also in the cure, the most trouble-
 some symptoms must be relieved by a proper diet,
 and suitable remedies, which may likewise prevent
 future symptoms, the chief of which are pain, inflam-
 mation, and all the bad consequences that may from
 thence follow. But of these we treated before, and
 shall in part consider them hereafter. But it is very
 apparent, that the more numerous and grievous symp-
 toms are to be expected, as the dislocated limb is

^e De Articulis, Textu 27, 28. Charter. Tom. XII. pag. 306,
 307.

^f Ibidem textu 29. pag. 308.

larger, since such a limb cannot be dislocated, but by the most violent causes, and will also require an extension proportionably strong to make the reduction. Hence Hippocrates ^g observes, that in the reduction of all joints, the patient must be enjoined to strict abstinence, especially where the articulation is very large, and the reduction difficult; but that abstinence is less necessary when the articulation is small, and easily replaced.

S E C T. CCCLXVIII.

THE reduction is performed, 1. by holding the patient's body firm; 2. by moving the limb so, that the bone may directly correspond to its cavity; 3. by introducing it into the cavity by pushing, turning, and striking it.

1. As more or less extension is required to reduce a luxation, it is evident that it cannot be performed without pain, by the reasons before mentioned, § 349, numb. 2. It is therefore necessary so to secure the patient, that he may not disturb the operator, and it is likewise necessary to prevent his whole body from moving, when the affected part is extended.

2. Galen ^h prudently advises, in treating of the cure of luxations in general, that it is necessary to replace or return the dislocated bone the same way in which it was displaced. Therefore the consideration of the expulsive causes which have preceded in every luxation, will be necessary, in order to return the bone from whence it was displaced: and then he illustrates the assertion by an instance of the humerus being dislocated forward. But how useful this admonition will be towards a happy reduction of dislocated bones, is sufficiently evident; for the bone which

^g De Articulis Textu 27, 28. Charter. Tom. XII. pag. 466.

^h Comment. 1. in Hippoc. de Art. Char. Tom. XII. pag. 204.

has receded from its natural place, makes itself a way by removing the adjacent parts, and may therefore more easily return by the way which it has already made, than by any other: and this more especially, if the bone is displaced by breaking the ligaments of the articulation; for in that case, if the bone is not directly moved to the same part, it cannot return into its natural situation. In order to perform this, an extension is necessary to be made more or less strong in proportion as the dislocated joint is smaller or larger; which extension is also necessary to prevent any of the adjacent parts from being intercepted, while the head of the bone is reducing to its proper seat. A sufficient extension may be generally made by the hands in luxations of the smaller joints; or in young and lax habits of body, even the same method may be sufficient for the larger joints; but if a stronger force is required, it will be often necessary to make use of slings and machines. A great many beautiful observations are to be found in Hippocrates's book *De Articulis*, concerning these machines, to which the moderns have added others; see also what has been said of them in the commentaries on § 349.

3. When the dislocated limb is once properly extended and directed, so as to correspond to its cavity, the remainder is then easily performed. Whence Hippocrates^a treating of a luxation of the femur inwards, says: *Si bene extensum fuerit, femoris caput e regione pristinae suae sedis attolletur; cumque sic sublatum fuerit, non facile prohiberi poterit, quominus in suam sedem revertatur; sic ut quævis impulsio & directio sufficiat. Sed deficiunt in extensione, idcirco majorem molestiam habet repositio;* “If the femur is rightly extended, its head will be drawn directly over-against its pristine or natural seat, and in this disposition it will not be easy to prevent it from slipping directly into its proper cavity or seat, to do which

^a *De Articulis*, Charter. Tom. XII. pag. 456.

“ almost any thrust or direction will then suffice. But
 “ if the assistants are defective in their extension, the
 “ reduction will be on that account the more diffi-
 “ cult.” For the elasticity of the ligaments, and
 strength of the muscles are frequently in that case
 sufficient to return the dislocated bone into its pro-
 per situation. But a knowledge of the structure of
 the dislocated joint will readily acquaint a skilful sur-
 geon what is further necessary to be done, if the
 bone does not slip into its seat, after it has been re-
 duced near to its cavity by a due extension; for
 then a gentle twisting, a stroke, or a thrust, will be
 frequently sufficient to replace the bone, while the
 extension is made by experienced surgeons. Thus
 Celsus^b, in treating on the reduction of the lower
 jaw, says, after having observed in what manner the
 patient ought to be placed and secured: *Ubi vehemen-*
ter maxilla apprehensa est, si una parte procidit, concu-
tiendum mentum, & ad guttur adducendum est: tunc
simul & caput adprehendendum, & excitato mento, max-
illa in suam sedem compellenda, & os ejus comprimendum
est, sic ut omnia pene uno momento fiant; “ When the
 “ jaw is taken hold of firmly, being dislocated on
 “ one side, the chin is to be struck with a blow, and
 “ directed back towards the throat: at the same time
 “ also the head is to be held fast, and by agitating
 “ the chin, the lower jaw is to be forced into its
 “ seat, pressing upon that bone in such manner, as
 “ to perform almost the whole operation in a mi-
 “ nute.” When surgeons endeavour to reduce a
 luxation of the humerus, by suspending the patient
 with his arm over a door, a ladder, &c. making a vio-
 lent extension, the arm hanging downwards, the dis-
 located joint then frequently returns to its situation in a
 moment. But how much it is for the surgeon’s interest
 and success in the cure, to be assisted with skilful
 hands, especially in difficult cases, is sufficiently ap-
 parent.

^b Lib. VIII. cap. 12. pag. 546.

That the dislocated bone is returned into its former situation, is generally perceived by the sound or noise which it makes in the moment of its reduction: but Celsus^c observes, *Quod caput humeri impulsum in suam sedem, modo cum sono, modo sine hoc, compellatur*; “That the head of the humerus may be pushed in-
“to its seat, as well without a noise as with.” But almost all surgeons have observed, that there is constantly at least something of an obscure noise to be heard at the time of the reduction. Fabricius ab Aquapendente^d seems to have been much alarmed with danger from this noise, imagining it to proceed from the collision of the head of the bone against the edge of its cavity, whence this last might be broke before the head of the bone could enter in the said cavity; and therefore he thought a compleat reduction to be impracticable: he likewise judged the noise to arise sometimes from the percussion of the head of the bone against its cavity or socket, from whence the worst symptoms might be afterwards feared. But daily experience, and the observations of the most faithful surgeons, sufficiently convince us, that this fear is without any foundation, since the noise is generally perceptible, and that without being followed by any of the bad consequences which might be justly expected from those causes. It was said before, in the commentary on § 365. that a distortion or alteration in the figure of the limb, is to be reckoned among the principal diagnostic signs of a luxation, if joined with the tumour in some other part. When the dislocated bones are properly reduced, it is evident that all these must again disappear. It is likewise observable, that pain always accompanies a recent luxation, from the violent distraction of the ligaments, and other adjacent parts; but so soon as the joint is reduced, that pain immediately ceases, or at least is much diminished: for sometimes a small de-

^c Lib. VIII. cap. 15. pag. 549.
V. cap. 1. pag. 350.

^d Chirurg. Univerf. lib.

gree of pain may continue from the violent extension, which the circumjacent parts and ligaments of the bones have suffered in the reduction, though ever so well made; since also a very strong extension is often required, before the reduction can be made.

S E C T. CCCLXIX.

AFTER the bones are reduced to their proper situations, they are to be retained there by rest, bandages, and a natural disposition or posture of the parts.

After the bones have been reduced to their proper situations from whence they were displaced, then the other part of the cure (§ 337. numb. 2.) still remains; namely, to retain them in that situation, but this is performed

By rest.] In every dislocation the confining ligaments of the joint have been either broke, or very much elongated; so that if rest is not ordered, the replaced bone may easily slip out again. It was demonstrated before in § 25. numb. 3. that the solid parts of the body, may be weakened by too great a distraction, and in § 28. numb. 5. it was affirmed, that the strength or cohesion of the solids is increased by the long continuance of all the parts in the same contact, which is sometimes carried so far, that they at length acquire too much strength or stiffness: Rest will be therefore always necessary to restore the strength of the over strained ligaments, or to procure an union of them if they are broken; but care must be taken not to let the ligaments become rigid by too long a rest, nor to give occasion for an anchylosis to be formed by an accumulation of the mucilage of the joint, which may become inspissated for want of motion. Hence it is adviseable to gently move, and rub the joint for some days after it has

been dislocated, provided all the pains are abated, and there is no danger of an inflammation, as Hippocrates ^a carefully observes, in treating of the cure of a luxation in the humerus. But Celsus ^b remarks, that this caution ought more especially to be observed in a dislocation of the elbow, when he says; *Celerius tantum sæpiusque id resolvendum est, multoque magis aqua calida fovendum, & diutius ex oleo & nitro ac sale perfricandum. In cubito enim celerius, quam in ullo alio articulo, sive extra remansit, sive intus revertit, callus circumdatur; isque, si per quietem increvit, flexus illius postea prohibet;* “The dressings are to be speedily and often removed, the part is to be well fomented with warm water, and to be rubbed for a considerable time with oil, salt, and nitre. For a callus is sooner formed in the cubitus than in any other joint, whether it remains displaced or reduced to its proper situation. And if it should by rest concrete, the flexibility of the joint will be afterwards destroyed.”

Besides this, the pain or inflammation, which often continues from the violence offered to the injured parts, also requires the limb to be kept at rest for some time after the reduction.

By bandages.] Unless the ligaments are quite broke, or violently stretched, the reduced bone may be easily retained in its situation, barely by keeping the part at rest: so that bandages are not always necessary. Agreeable to this, we are told by a very skilful surgeon ^c, that he applied no bandages after a reduction of the lower jaw, and yet the cure succeeded very well. But if there is any danger of a relapse in the dislocated joint, it may be best to secure the part with bandages; especially if the pressure of the compresses and other dressings is determined by the bandages mostly to the affected part from

^a De Articulis, textu 30. 31. Charter. Tom. XII. pag. 308.

^b Lib. VIII. cap. 16. pag. 551.

^c De la Motte Traité complet de Chirurgie, Tom. IV. pag. 335.

whence the bone was displaced. This has been very well observed by Hippocrates ^d, in treating of a luxation of the humerus, where he says: *His ergo mederi oportet cerato & spleniis, & multas fascias circumdare: supponere autem axillæ lanam mollem puram convolutam, quæ cavum (axillæ) repleat, ut vinculum fulciat, & articulum sustineat*; “These luxations ought
 “ therefore to be secured by plaisters, compresses, and
 “ the application of many bandages: but in the ax-
 “ illa is to be fixed a piece of woollen cloth rolled
 “ up, sufficient to fill the cavity of the armpit, in
 “ order to sustain the joint and fill out the bandage.”
 For by this means the head of the bone may be prevented from slipping out again from its seat into the cavity of the axilla, which, Hippocrates ^e says, is the only manner in which the humerus can be luxated, as far as he could ever observe; and therefore he has not treated of the other species of this luxation.

But it is very evident, that by knowing which way the bone has been displaced from its cavity, it may be prevented from slipping out again by the application of a bandage suitable to each particular luxation. But when the part has been thus secured by bandage, it should be seldom opened, unless an inflammation should attend; for then the apparatus of dressings are to be more frequently removed in all luxations, according to the direction of Hippocrates ^f.

The natural posture of the part.] It is evident the part affected must be kept at rest a considerable time; but that it may be so retained without uneasiness, it will be necessary to place it in the same posture in which we observe the limbs when a person is sleeping, and when none of the muscles are acting, by the influence of the will: but at that time the flexor muscles of the limb do by their contraction prevail over the

^d De Articulis, textu 29. Charter. Tom. XII. pag. 308.

^e Ibid. textu 3. pag. 290.

^f Ibid. pag. 466, 467. in fine libri.

extensor muscles; from whence it is that we observe almost all the joints a little inflected. See what has been said concerning the natural situation of the parts in the commentary on § 349. numb. 3. Therefore Hippocrates ^g lays it down as a general rule in every luxation, *Semper quiescere læsum articulum convenit, & quam optime figurari*; “That it will be always proper to keep the injured joint at rest, and in the most convenient posture.” And hence he describes the particular posture most convenient for each luxation. Thus, for example, in treating of a luxation of the cubitus, he says ^h, that the part ought to be so disposed in the cure, that the extremity of the hand may be a little higher than the cubitus, while the arm is placed by the side of the body; for by that means it may be suspended and carried without any uneasiness, and it will be likewise more commodious for use, and agreeable to nature.

All these particulars being duly observed, we may reasonably expect an happy cure when the bone has been dislocated by some external violence; but when the bone has slipped out of its cavity from a relaxation of its ligaments, the cure then will be much more difficult; whence Celsus ⁱ pronounces, *Qui nervorum vitio prolapsi sunt, compulsi quoque in suas sedes iterum excidunt*; “Those joints, which are dislocated through a defect in their ligaments, slip out again, even after they have been reduced to their proper situations.” The reduction of these luxations is indeed very easy, but the retention of them is very difficult, and even sometimes quite impracticable. All the hope then in this case depends upon a long continued rest of the part, with the application of strengthening fomentations, which may restore the relaxed ligaments to their due firmness. Petit ^k has observed happy success in these cases from the application of

^g De Articulis, Textu 29. Charter. Tom. XII. pag. 467.

^h Ibid. pag. 331.

ⁱ Lib. VIII. cap. 11. pag. 544.

^k Acad. des Sciences l'an. 1722. Mem. pag. 163.

thick compresses dipt in aromatized spirit of wine, and spread with a mixture of powdered allum with the white of an egg secured all round the articulation of the femur by a convenient bandage; and he frequently applied the same medicine to moisten the bandages and compresses without removing the apparatus. Galen tells us ¹, that he has twice cured a luxation of the femur proceeding from a relaxation of the ligaments; but affirms, that the articulation ought to be invested for a considerable time with drying medicines, in order to remove the redundant humidity of the ligaments. Even Hippocrates acknowledges so much difficulty in the cure of these luxations, that he has recourse to the last refuge of the art, namely to fire or cauterization. For he observed that many were by this accident rendered incapable of war and other exercises, nor did he ever know any one who rightly treated them, and therefore he is the more large in his description for this method of cure. But he speaks principally of that species of luxation, in which the head of the humerus slips into the axilla; though it is also very evident, that the same method of cure is likewise applicable to other luxations, both of the same and of other joints.

The whole design of the cure seems to consist in forming a cicatrix by the actual cautery in the skin and panniculus adiposus, whence the integuments are so much hardened as not easily to admit of being extended, so as to prevent the bone from slipping out again the same way. He orders the arm to be a little elevated, (for if it is not raised one cannot have free access to the axilla; and if it is raised too much, the skin will be drawn so tight that it cannot be conveniently taken hold of) and the loose skin with the panniculus adiposus to be pulled out by the fingers, so that the integuments may recede a good way from the glands, large nerves, and considerable blood-vessels which are there seated.

¹ Comment. IV. in Hippocrat. de artic. Charter. Tom. XII. pag. 453.

He then orders the elevated skin to be very speedily perforated with an actual cautery, which is not thick but rather long and round; and he would have the iron to be so far heated as to be white or pellucid (*χρὴ δὲ διαφάνεσι καίειν*): then the skin being as yet elevated is to have a slender spatula (*ὕπάλειπρον*) passed thro' the two apertures made by the cautery, which being done the skin is to be let loose, and another perforation made by a slender cautery forced through the integuments till it meets with the subjacent spatula. Thus the part may be cauterized in three distinct places without danger of injuring the subjacent parts. Now during the time of the cure the eschars will be separated, and then the integuments will unite or grow to each other, but in such a manner, that they will be rough and hard with the scars occasioned by the loss of substance made by the cauteries: and therefore he advises not to raise the arm much during the whole time of the cure, but only to elevate it so much as will be necessary for dressing the wounds; for thus the integuments not being distended will give an opportunity for the lips of the wounds to cohere and unite with each other the more firmly and strictly. Even after the cure of the wounds, Hippocrates would have the arm tied down to the side for a considerable time, that the cicatrices may be rendered more firm and secure, and that space contracted where the humerus used to prolapse. Hippocrates has also pointed out two other places where cauterization may be serviceable in this case; namely on each side the head of the *os humeri*, betwixt the bone and the large tendons which form the cavity of the axilla on each side; namely the tendons of the pectoral muscle and *latissimus dorsi* ^m.

In like manner I remember the cure of ruptures was attempted formerly by a certain empiric, who,

^m Hippocrat. de Articulis, Textu 41, &c. Charter. Tom. XII. pag. 312—320.

after returning the prolapsed intestines, deeply cauterized the integuments of the rupture, either with the actual or potential cautery; and this with a view, that they, being contracted with a deep cicatrix, might not so easily yield afterwards to any extension.

Of INFLAMMATION.

SECT. CCCLXX.

AN inflammation, which is sometimes called a phlegmon or fire, is so denominated from the similitude both of its causes and effects with those of fire.

Before we proceed to treat of acute diseases, it is best to premise the history of inflammation with all its consequences, because that will afford much light into the nature of those diseases; and the successive changes made by an inflammation in the external parts of the body towards health or another disease, may be more distinctly understood; and from thence one may foresee what will follow when the like disorder invades the internal parts of the body.

General custom has in all languages (as far as I can find) imposed a name to this disorder from that of fire: Thus it is termed *inflammatio* by the Latins, and *phlegmon* or *phlogosis* by the Greeks. Nor need we wonder at this, since the greater heat, which was ever ascribed by all people to an inflammation, is proved from physics to arise from a greater quantity of fire. Thus says Galen^a; *Hic vero tumor, assumens pulsum & igneum ardorem, antea proprie vocatam phlegmonem perficit. Non autem sic veteres; sed quemcunque ardorem vocabant phlegmonem, uti sæpius vobis demon-*

^a Comment. 3. in Lib. Hippocrat. de Fracturis. Charter. Tom. XII. pag. 236.

stratum fuit. Verum ab Erasistrati temporibus solitum fuit, phlegmones nomen dici de illis tumoribus, in quibus non tantum est calor inflammans, sed & renixus & pulsus: ex necessitate vero habent & sic vocatum ruborem, &c. “ But this tumor, assuming a pulsation and fiery heat, answers then properly to the ancient title of phlegmon. But the ancients do not thus distinguish it; for they called any heat or inflammation a phlegmon, as I have frequently demonstrated. But from the time of Erasistratus it has been customary to term these tumors phlegmons, in which there is not only an inflammatory heat, but also a resistance and pulsation; they have also of necessity a redness so called,” &c. And in like manner in another place^b he mentions heat among the diagnostic signs of a phlegmon. And thus Ægineta^c says, *Communiter quidem calidos omnes & dolentes cum ardore tumores phlegmonas vocare consueverunt. Pro diversitate vero materiæ, efficientis ipsos, horum quoque differentiam variare dicunt. Sanguine namque bono & moderatæ crassitiei in partem aliquam confertim irruente, & ob copiam impacto, proprie diætam Phlegmonem fieri; bile flava autem in quadam parte hærente, Herpeta; sanguine vero cum bile flava irruente, Erysipelas. Quando vero sanguis influens calidus admodum fuerit & crassus, carbones parere solet;* “ That indeed it was usual to call all hot tumors, accompanied with pain and burning heat, by the name of phlegmons. But that even these are said to differ according to their efficient matter. For good blood of a moderate consistence flowing plentifully and forcibly into any part, being there impacted by its quantity, occasions the Phlegmon properly so called; but yellow bile lodging in any part forms an Herpes; and blood flowing together with yellow bile causes an Erysipelas.

^b De Tumoribus præter Naturam, cap. 2. Charter. Tom. VII. pag. 313.

^c Lib. IV. cap. 17. pag. 63. versa.

“ But when the influent blood is very hot and thick,
 “ it usually produces carbuncles.”

Heat was therefore a common sign of every inflammation among the ancients, who gave the common appellation of phlegmon to all kinds of inflammation; but they afterwards restrained it only to that species of inflammation, in which there was a resisting tumor, accompanied with a redness, and a burning heat; but to the other species of inflammation they gave different names. Thus in Celsus^d we read, *Notæ inflammationis sunt quatuor, rubor, & tumor, cum calore & dolore*; “ That the signs of inflammation
 “ are four; to wit, a redness, and tumor, with heat,
 “ and pain.” Whence it appears, that the general name of inflammation was even among the Latins restrained to only one particular species.

But that there is a greater quantity of fire in the inflamed part is demonstrated by thermometers, and the effects being quite similar to those which arise from the application of elemental fire to the body. For when a healthy person applies the back of his hand to a fire, he begins to perceive a greater heat, then the part will become red; and if he applies it still nearer to the fire, it will swell and become painful; but if he continues to approach with his hand still nearer to the fire, the pain will be violently increased, the cuticle will be raised into blisters, and at length the skin itself will be burnt up into an eschar by the increased action of the fire; which eschar being absolutely a dead or foreign substance, must be separated from the living parts by a suppuration: but the ill consequences of an inflammation are altogether the same with these, and arise in the like order. For a slight heat, redness, and tumor, attended with pain, form an inflammation on the back of the hand; all which symptoms have increased in proportion to the disorder itself. But from a violent inflammation tending to a gangrene, the cuticle is also raised into blif-

^d Lib. III. cap. 10. pag. 139.

ters, and gangrenous eschars are formed, which must be likewise separated from the living parts by suppuration: and if the inflammation still continues increasing in violence, all the parts appear black even to the bone, in the same manner as if they were burnt by the fire; and then the part is said to be mortified or sphacelated. Hence also Hippocrates calls an ardent fever by the name of fire, ($\tau\acute{o} \pi\tilde{\upsilon}\rho$) because in that disorder there is often so great a heat felt in the vital organs, as if there was a real fire; from whence death often ensues very suddenly. And in the most ardent fever, the plague, when the malignity of the distemper is translated to some particular part of the body, it is observed to be burnt up in such a manner, as if it was actually occasioned by fire; as is evident in the pestilential carbuncles, which are afterwards separated and thrown off by a suppuration all round them; and this perfectly in the same manner as is usual when any part of the body has been burnt by a red hot iron. Thus the wise ancients did, by observation only of the effects of an inflammation, denominate it justly from fire; since both the causes and effects of each are alike: and the modern observations concerning the nature of fire are a strong confirmation of all that has been here said.

S E C T. CCCLXXI.

AND it consists in a greater pressure and attrition of the red arterial blood, stagnating in the smallest vessels, and urged by the motion of the rest of the blood, which is more forcibly agitated by a fever.

In this aphorism we are furnished with a definition of an inflammation or phlegmon, properly so called from its causes, and denominated so by the ancients from its symptoms. For they defined a phlegmon,
(as

(as is evident from what we lately cited from Galen under the preceding aphorism,) that it is a preternatural tumor, hard and resisting, with redness, heat, and a pricking pain, accompanied generally with a fever. But it must be observed, that this definition here given relates only to the inflammation so far as it extends to those vessels, which naturally contain red blood, or which at least may by dilatation admit the blood. But as for what relates to this disorder, when it is seated in the most slender or lymphatic vessels, we shall treat hereafter at § 379, 380. This being premised, we may be able to explain the definition above given.

In this disorder there are two concurring causes, which together constitute the nature or existence of inflammation; namely obstruction, with an increased velocity of the blood flowing into the obstructed vessels. For the blood stagnates in an inflammation, and cannot pass through the smallest vessels, even though it be urged forward by the impulse of the succeeding blood; there is therefore an obstruction of the vessels denying a passage to the humours which they ought to transmit. But it is evident from what has been said on § 107. that an obstruction is formed whenever this passage or transmission of the humours through the vessels is cut off. The obstructing matter is the red blood of the arteries; because it is in the arteries only, that an obstruction, properly speaking, can take place, as we demonstrated in the commentary on § 119. But the parts of the vessels obstructed are their smallest branches and extremities, since it is evident, that the obstructing particles may be as yet able to pass through the larger vessels; but then they will be stopped towards the ends of the smaller converging vessels. But we do not here understand the smallest vessels of all in the body, but only the smallest branches of the largest; those namely which contain the grossest part of the humours, the red blood. So that these vessels may be called the

the smallest with respect to the largest of their own genus, but with respect to those which are still smaller, even these may be termed large: for the ultimate ends of the sanguiferous arteries will be always larger than the serous artery which thence arises, and which by the smallness of its diameter naturally excludes all the red blood. Thus it also is in the last extremities of the serous arteries, which will for the same reason be always larger than the lymphatic artery thence arising, &c. Hence it is evident, that a true phlegmon is almost constantly seated in the smallest sanguiferous arteries, or else in the serous arteries dilated; and therefore this is the inflammation of the first order, as we termed it at § 122. But when the obstructing particles stagnate at the ends of the smaller vessels, they will be necessarily compressed by the action of the vital humours behind; and this even with no small force, since it is by the force of the heart and arteries that the blood flows into the obstructed part with such a velocity or impetus, as would be sufficient to convey it through the extreme parts of the body, with a considerable degree of its velocity still remaining; whence the pressure must be great, and renewed at every contraction of the heart and arteries. (See the commentary on § 120.) But as the obstructing particles seem to remain immoveable, wedged into the extremities of the smaller vessels, it does not so readily appear from whence the attrition must arise, which seems to suppose the influx and return of these particles. But if what has been said in the commentary on § 132. numb. 1. be duly considered, the obstructing particles will appear to be not always immoveable or at rest, but sometimes repelled by the contraction of the arteries towards their larger diameter, and then again propelled forward by the force of the heart filling the arteries, and urging the blood into their smallest extremities; and from hence it is that a real attrition is here produced.

All that has been hitherto said is also applicable to obstructions in the smallest vessels formed by a stagnation of the red arterial blood, and therefore it is added in the definition *more forcibly agitated by a fever*. When a violent inflammation has invaded any of the viscera or more considerable parts of the body, we then always find it accompanied with a fever; but if the inflammation is seated in the smaller parts of the body, especially the external, it may be then questioned whether a fever is always present; for an inflammation of the eyes, an inflammatory quinsy, &c. are frequently observed without any sensible alteration in the pulse. This is very well explained by Galen^a, where he describes the nature of pulses which accompany inflammation; *Incipiente enim inflammatione pulsus major est, quam secundum naturam, & vehementior, & celerior, & crebrior. Aucta inflammatione omnia hæc crescunt, & manifeste durior fit, &c.* “For at the beginning of the inflammation the pulse is larger, stronger, swifter, and more frequent than according to nature. But when the inflammation is increased, the pulse is also increased in these respects, and becomes manifestly harder,” &c. And a little afterwards he adds, *Hæc inflammatio habet, quæ pulsus per totum corpus immutat, sive ob magnitudinem, sive ob principem partem, in qua consistit. Si vero universum corpus non afficiat, pulsus in parte inflammata talis erit, qualem diximus;* “This inflammation has something in it which changes the pulse throughout the whole body, either from the magnitude of it, or the importance of the part, in which the inflammation is seated: but if the whole body is not affected, the pulse will be found thus (as we before described it) in the inflamed part itself.” It is therefore under this restriction, that we are to understand the assertion that a fever is a general companion with every inflammation, at least in the

^a De Pulsibus ad Tyrones, cap. XII. Charter. Tom. VIII. pag. 8, 9.

inflamed part, if not in the whole body; since the strength and quickness of the pulse will be there increased, so as to occasion as it were a fever of the part itself, as Galen^b very well observes in another place. For after saying that there are a great many different sorts of inflammations, he observes, that a fever usually accompanies all of them. He then places the principal difference of inflammations in their being dry or moist: *Humida quidem, quæ ex calida fluxione partem obsidente fit: sicca autem, quando sine ulla fluxione connatum calorem accendi contingit. Hoc autem quodammodo velut febris partis ipsius est;* “ That
 “ the moist inflammation is indeed that which is
 “ formed by a hot defluxion invading the part: but
 “ the dry inflammation happens when the heat endeavours to inflame without any defluxion; and this
 “ is in a manner a fever of the part itself.” It is also a firm opinion of the ancient physicians, that an inflammation is always accompanied with an increased motion: for Celsus^c in his preface, where he relates the different sects and opinions of physicians, has the following passage: *Si sanguis in eas venas, quæ spiritui accommodatæ sunt, transfunditur, et inflammationem, quam Græci φλεγμασιν nominant, excitat, eaque inflammatio talem motum efficit, qualis in febre est, ut Erasistrato placuit;* “ If blood is forced into those vessels,
 “ which are destined for lymph or spirits, it occasions
 “ that inflammation which the Greeks call a phlegmon, which inflammation has the same motion as
 “ in a fever, according to the opinion of Erasistratus.” Here we are to observe, that he does not say simply that a fever arises whenever there is an inflammation, but only that there is the same motion attending an inflammation as attends a fever.

Hence we have a very salutary admonition proposed in the practice of physick by Dr. Simson^d, that

^b De Meth. Med. ad Glaucon. Lib. II. cap. Charter Tom. X. pag. 367. ^c pag. 5. ^d The System of the Womb, &c. by Thomas Simson, pag. 106, 107.

the physician may not be deceived by imagining there is no inflammation when there is no fever. For there are often fixed pains which cause an inflammation of the stomach and intestines, even when no fever can be observed by an examination of the pulse: and he even asserts, that he has seen bastard pleurifies epidemical which would have afflicted the patient for several months without any fever, unless they had been treated immediately with bleeding and other remedies proper to abate inflammation.

From what has been said it is also evident, that obstruction has many things in common with inflammation, but that no inflammation can be conceived without an obstruction also attending: besides which, we demonstrated in the commentary on § 120. that a violent obstruction increases the velocity of those juices which are to pass through the pervious vessels; that is, it occasions a fever. But so soon as a fever accompanies the obstruction, there is then an inflammation; which may be therefore termed an obstruction with a fever, either in the whole, or only in some particular part of the body.

S E C T. CCCLXXII.

WHICH disorder may therefore take place, either in the extremities of the sanguiferous, ferous, lymphatic, or other lesser arteries, whose mouths being dilated admit the red globules, or the gross particles of some other fluid, incapable of passing through their extremities. If blood is transfused into those vessels, which are destined to lymph or spirits, it excites an inflammation, says Celsus, pag. 5.

It is therefore evident from the definition given in the preceding aphorism, that an inflammation or phlegmon, properly so called, can take place only in those

those vessels which naturally contain red blood; or else in those vessels, whose orifices are so dilated by disease, that they admit the red part of the blood. For the particles of a fluid thinner than the red blood, being concentered from any cause in the other smaller vessels, may also occasion an obstruction in them; and the fluid, pressing behind the obstructed particles may also occasion a greater velocity in those vessels, without producing any redness in the affected part; and then the disorder is not termed a phlegmon, but an erysipelas or œdema callidum, *etc.* as we shall explain it at § 379, 380. But how far the red part of the blood may penetrate, and into what number of the decreasing series of vessels it may enter, when their orifices are preternaturally dilated, cannot as yet be determined by experiment. In the mean time it is evident, that the red blood may not only enter by disease into the serous vessels, which naturally contain yellow serum, as being the next coloured fluid in grossness to that of the red blood; but it may also enter vessels which are still much smaller and which naturally contain only a pellucid lymph. The white of the eye, which resembles the brightness of a pearl in healthy people, becomes often so red by an inflammation, that one may perceive the innumerable ramifications of the vessels, which being distended with red blood, are visible enough to the naked eye; when in their natural state they contained only a colourless fluid. I have even sometimes observed, in the worst species of the ophthalmia, that there has been a vessel full of red blood passing through the very pellucid substance of the tunica cornea, conspicuous even to the naked eye; but there is no one can doubt, but that the vessels of the cornea, are much smaller than those of the adnata; since in an healthy state they are pellucid, as well as their contents. And a violent inflammation there arising often occasions a red circle, visible for a considerable time around the edge of the cornea, from a distention of the vessels with red

blood, while there is no defect as yet apparent in the cornea itself; but at length the small vessels of the cornea being gradually dilated, by the violence and continuance of the disease, they may also admit the red part of the blood. From hence it is evident, that a true phlegmon or sanguine inflammation may sometimes take place even in very minute vessels.

As to the passage quoted in this aphorism from Celsus, which we mentioned before on another account under the preceding aphorism; we are assured that the most antient physicians comprehended by the name of veins, as well those vessels which we now call arteries, as those which are properly called veins. It was the opinion of Erasistratus and many of his followers, that the pulsatile veins which we now call arteries, did not contain blood, but air or spirit, which occasioned the pulsation in those vessels. There were even a great many of his sect in the time of Galen who boldly maintained this assertion, and even promised to demonstrate that the aorta itself did not contain any blood; but Galen^a justly laughs at them, and evidently demonstrates by experiments the falsity of their assertion.

So that if we interpret this passage of Celsus by the opinion of Erasistratus, he must have supposed an inflammation to arise from the blood passing out of the veins into the arteries, which were judged to be naturally void of blood; that is an hesitation of the blood in other vessels. But we, being at present acquainted with the circulation of the blood, know better; though even their assertion may be countenanced in one sense; since an inflammation in reality arises, when the blood passes out of its proper vessels into those which naturally contain more subtle juices.

See more upon this head in the commentaries on § 122, where we treated of the different kinds of in-

^a De Anatom. Administ. Lib. VII. cap. 16. Charter. Tom. IV. pag. 164, &c.

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flammation, as arising from the different diameters of
the several series of decreasing vessels.

S E C T. CCCLXXIII.

THE feat therefore of this disorder may be every part of the body, in which there are reticular distributions of sanguiferous and lymphatic arteries.

After Ruysch discovered by his injections, that in almost all parts of the body, the arteries were divided and distributed into the most minute branches, and that the small branches arising from larger branches communicated with each other, and with the adjacent small branches; it has from that time been customary with physicians to denominate these distributions of arteries, net-works (*reticulæ*) or reticular plexuses, because there are small spaces left betwixt the branches, which unite together in the manner of a net. During the many years which that anatomist diligently prosecuted his injections, he often found (as we may perceive in many parts of his works) that there were intermediate spaces left betwixt the reticular plexuses, which seemed to be destitute of vessels; but by a more successful repletion, he afterwards demonstrated innumerable vessels even there distributed, almost in the same order as he before observed in the larger branches. But wherever the arteries are found to divide into the smallest branches, there the particles of the blood or lymph may hesitate, being rendered impervious by concretion, or some alteration of their figure; or even from a diminution of the diameters of those small vessels, by which they are rendered less capacious, the free passage of those juices which ought naturally to flow through them, may be again impeded; and from

hence we have an obstruction, which with an increas'd motion of the juices, (*a tergo*) behind, produces an inflammation. Now, as in almost all parts of the body there are small branches derived from the sanguiferous arteries, which by their minuteness exclude the red part of the blood, it is evident, that by a dilatation of the mouths of those vessels the red parts of the blood may mistake their course, and enter the smaller vessels; in the narrowest parts of which they will stop and become impervious: from whence again all the like inflammatory symptoms may arise.

S E C T. CCCLXXIV.

HENCE the seat of an inflammation may be as well seated in the arteries themselves, as in the veins, nerves, membranes, muscles, glands, bones, cartilages, and tendons, with all the viscera; and therefore throughout almost every part of the body, but in no part more frequently and violently than in the fat.

Since it is evident from the modern anatomy that almost every part of the body contains vessels which are capable of being demonstrated to the eye; it is therefore apparent, that an inflammation may arise almost throughout the whole body, and especially in those parts which are enumerated in this aphorism.

Arteries and veins.] The coats of these vessels are composed of other smaller vessels, as is demonstrable to the eye by injections, in their larger trunks. And even in animals which have been killed after a long hunting or coursing, the whole external superficies of the aorta has been often observed to be almost black, from the too great distention of those small vessels with blood, which are by an admirable intertexture distributed through the coats of this largest vessel.

vessel. We also treated of this in the commentary on § 113. numb. 2. where we enumerated a tumour of the smaller vessels, spent in the coats of the larger, among those causes which diminish the capacity of the larger vessels.

Nerves.] The nerves may be considered two ways, either as they are composed of a tender production of the medulla of the brain, cerebellum and spinal marrow, or, as they are composed of tough membranes, or cases furnished with all sorts of vessels. (See the comment on § 181.) in which membranous cases, the very soft and pulp-like substance of the encephalon and spinal medulla is safely conveyed to all parts of the body. But whether or no those extremely minute vessels, which escape all our senses, and compose the substance of the nerve properly so called, are at any time inflamed, is not so evident: but as a very thin fluid passes through them from the brain, cerebellum, and spinal medulla, as we observed in the commentary on § 181. it therefore seems reasonable, that a disorder of the like nature may also take place in these most minute vessels. But it is evident enough, that a true inflammation may take place in those larger vessels, which are demonstrated to the eye by anatomical injections, distributed throughout the constituent coats of the nerves.

Membranes.] For we at this time know by anatomical injections, that the most solid membranes, which the ancients imagined to be altogether bloodless, are little more than mere intertextures of vessels.

Muscles and tendons.] It is evident from injections, that an infinite number of arteries are every way dispersed through the flesh or body of the muscle; and we also know, that even the tendons, which appear so very white and compact of themselves, do by anatomical injections become quite red, not only from a repletion of those vessels which are spent in the capsules investing the tendons, but also of those vessels which are in the same manner dispersed, and run in

great numbers betwixt the fibres of the tendon itself. From whence it is evident, that an inflammation may be likewise here seated; and in a violent rheumatism the muscles are often so much inflamed, that the most excruciating pains arise even from the slightest endeavour to contract them.

Glands.] Whether they be mere convolutions or bundles of vessels, or only hollow cells discharging their contained juices by emissaries, after they have been secreted from the innumerable small vessels which creep upon the membrane of each cell; for the thing will be quite the same in both: for in both cases the fabric of the gland is asserted to be composed of an infinite number of small arteries; whence it is evident, that in these an inflammation may arise, as we are assured by daily observation in the parotid, submaxillary, axillary, inguinal, and other glands.

Bones.] I believe it was sufficiently proved in the commentaries on § 249, 252, 253. in the history of wounds of the head, that vessels are conveyed from the periosteum into the substance of the bone, and pass betwixt its lamellæ; and that others enter through particular small holes to the diploe of the cranium, and which in other bones extend to the medulla; and hence the separation of the corrupted part, and the reproduction of what is lost, is ascribed to the efficacy of those vessels themselves which are dispersed through the substance of the bone. Therefore an inflammation may arise in this solid part, either in the arteries which run betwixt the bony lamellæ, or in the vessels of the medulla itself, from whence arise most obstinate and deep pains, a *spina ventosa*, *etc.* as we shall hereafter explain, when we come to treat on the diseases of the bones. Even Galen ^a has formerly observed, that the bones are sometimes liable to inflammation; for after saying that the coats of the vessels, with the membranes, tendons, and nerves may

^a De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 315.

be inflamed, he adds: *Quamobrem ossa quoque nonnunquam inflammatio attingit, uti et ex ipsis primo affectis aliquando prorumpit* (ὄρημαται.) “Wherefore an inflammation does also sometimes penetrate into the bones; and sometimes it is extended from the bones, when they are first affected.” From what preceded the passage we have now cited, it is evident, that Galen intends that an inflammation of the incumbent parts may extend not only into the bones, but also that an inflammation first formed in the bones may be sometimes extended from them to the other circumjacent parts.

Cartilages.] The cartilages come next in structure to that of the bones, and many of them are in time converted into bones, as is apparent from osteogeny. But as we find a vascular structure in those bones which were once cartilages, it seems very probable, that the like structure existed before in those cartilages: and besides this, the diligence of anatomists has discovered and demonstrated vessels in the cartilages. Thus Dr. Havers^b affirms, that he has observed a hundred pores in the thyroide cartilage, which admit vessels from the perichondrium into the substance of the cartilage, and other pores which transmit the returning vessels. By a happy injection of young bodies, Ruysch^c has observed blood vessels to penetrate through the body of the patella, and to pass in great numbers into its medullium. And in another place^d he confirms this, in saying that he can demonstrate to the eye, that there are real blood vessels distributed within the cartilages themselves; and that he discovered them even in the cartilaginous superficies of the head of the os femoris, and in the margins of the moveable cartilages which are placed in the articulation of the knee, betwixt the ends of the bones. But as these vessels proceed from the con-

^b De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 282. ^c Adversar, Anat. Dec. 2. pag. 3. ^d Ibid. Dec.

3. pag. 33.

tiguous bone into the cartilage, he was surprized that they extended only to about the length of two lines, and never emerged into the outer surface of the cartilage. From hence therefore it is evident, that an inflammation may take place as well in the cartilages as in the bones.

All the viscera, and therefore almost throughout every part of the body.] That the viscera are composed of vessels wonderfully complicated or disposed, and in a different manner in each particular viscus, we are acquainted from the modern art of injection; and the acute diseases of the viscera, which we shall hereafter consider, will evidently show, that an inflammation with all its consequences, a suppuration, gangrene, scirrhus, *etc.* are sometimes observed in these; and this not without excepting the heart itself, notwithstanding Pliny will have it to be the only viscus which does not waste by disease, nor draw any assistance from life, but being injured, causes instant death, as we observed in the commentary on § 304. For the pulpy substance of the heart being suppurated in a woman, she discharged a purulent matter for many days by urine, and when she was dead, four months after upon opening her body, an abscess, and some small stones were found in the heart, as Holle-rius^e testifies. From hence it is justly concluded, that almost every part of the body is liable to inflammation, since it is demonstrated from the modern anatomy, that almost every part of it is vascular.

But is in no part more frequent and obstinate than in the fat.] We are well assured that the cellular membrane extends almost into every part of the body, and acquires different denominations, according to the different matter which it contains. For if it contains a white and hard fat in its cells, not fusible without heat, it is then called tunica adiposa; but when the matter contained in this membrane is soft and oily, it is then termed pinguedinosa. But in those parts of

^e In Commentariis in Coac. Hippoc. pag. 824.

the body where this membrane is thinneſt, its cells being empty of oil or fat, eſcapes the eye, and is termed ſimply cellulofa; as, for inſtance, in the back of the hand, the forehead, *etc.* But how far this membrane extends itſelf throughout the human body, will appear, if we conſider, that not only all the muſcles and tendons are inveſted with ſuch a cellular membrane, but that even every muſcular fibre, as far as the eye and patient hand of the moſt acute and dextrous anatomift has been able to penetrate, is alſo inveſted with the like cellular membrane. Almoſt every veſſel in the body runs in or through ſuch a cellular ſubſtance, which in part conſtitutes the fabric of the veſſels and viſcera themſelves. From whence it is evident, that an inflammation may frequently ariſe in this cellular or adipoſe membrane; and when it is once ſeated in this part, the inflammation uſually proves very ſtubborn; being frequently incapable of a diſcuſſion, and tends either to a ſuppuration or a gangrene. Now as the arteries which are diſperſed through this membrane, do uſually in their natural ſtate ſecern a fat oil or unctuous liniment, ſerving to lubricate the parts, for which uſe it is deposited in the cells of this membrane, it would therefore ſeem, that theſe veſſels being dilated or broke by an inflammation, will occaſion the red part of the blood itſelf to tranſude and be accumulated in theſe cells; and from hence that hard and red tumor ſeems to ariſe, which accompanies the true phlegmon, whoſe ſeat is almoſt conſtantly in this cellular membrane only. Galen^f has very well expreſſed this affair, in a ſentence which we quoted before upon another occaſion, in the commentary on § 118. *Quum ſanguis calidus copioſior in aliquam animalis partem procubuit, majora ejus vaſa protinus diſtenduntur, quæ plenitudinem non ferunt; ab his deinceps quæ minora ſunt. Mox ubi nec in iis ſatis continetur, exſudat foras in illa ampla ſpatia, quæ inter vaſa ſunt, ſic ut etiam omnia, quæ in com-*

^f Method. Med. Lib. X. cap. 6. Charter. Tom. X. pag. 233.

300 Of INFLAMMATION. Sect. 374, 375.
posita carne habentur, loca occupet; “ When the hot
“ blood flows more plentifully into any part of the
“ animal, its larger vessels will be immediately dif-
“ tended, which not being able to support the pleni-
“ tude, the blood will then flow from them into the
“ smaller vessels. But soon after this, the small ves-
“ sels not being sufficient to retain it, the blood will
“ transude or escape into those large spaces which lie
“ betwixt the vessels, so as to occupy all of them,
“ which are in the composition of the flesh.” But
by flesh Galen here understands the adipose or cellu-
lar membrane, as is sufficiently evident from what he
writes in the last chapter of the same book. Besides
this, it is also confirmed by the event of inflamma-
tion, that the seat of it is most frequently in the cel-
lular membrane. For if a violent inflammation be
followed with a suppuration or a gangrene, the con-
fined matter or gangrenous ichor is observed, upon
perforating the skin, to be lodged always in the cel-
lular membrane. Thus I saw, in a frightful gangrene
which extended through the leg from the knee to the
ends of the toes, that a large part of the panniculus a-
diposus came away while the subjacent muscles and
tendons were quite found.

SECT. CCCLXXV.

THIS stagnation (371.) is caused in the
smallest arteries, 1. by every thing which
contracts or diminishes the conical or cylindrical
ends of the small vessels, in such a manner that
their diameter or opening, becomes less than the
diameter of a blood globule; whether this be
done by pressure, distraction, contortion, rupture,
contusion, burning, erosion, or shrinking of their
membranes. To these add, heat, violent motion,
foreign bodies in the flesh, ligatures, incumbent
weights,

weights, acrid substances, either taken as food, or applied externally, severe cold, too much friction, and all the causes of wounds, contusions, erosions, fractures, luxations, and obstructions.

In the definition of an inflammation in § 371. two things were considered: namely, a stagnation of the red parts of the blood in the smallest arteries, and a pressure or attrition from the blood pressing behind with a greater impetus against that which was obstructed. In this aphorism are enumerated those causes which occasion that stagnation in the smallest arteries; which yet, in their natural state, are capable of transmitting the red part of the blood through their smallest extremities.

I. The arteries which convey the red blood, having first carried off the thinner parts by their lateral branches for various purposes, do then transmit the red globules (which are of a size too large to enter the smaller vessels) from their smallest extremities into the veins, with which they form a continued vessel. Therefore where one of these smaller arteries terminates, there the vein begins; now the artery, in its course, always diminishes gradually from a larger capacity to a less; but the veins are the smallest at their origin, and gradually enlarge through their whole course. Hence the humours pass in the arteries from the basis of the cone to the apex; but in the veins they pass from the vertex towards the basis of the cone. But in those parts where the artery becomes smallest, and forms itself into the continued smallest veins, there the vessel seems to be cylindrical, at least for a small space, the sides neither converging nor diverging: and if the cylindrical vessel proceeds, either towards the artery or towards the vein, it then assumes the figure of an erect or an inverted cone. But in this part where the sanguiferous artery terminates, and the smallest vein thence arising begins, there

there is the smallest diameter, or the narrowest part of the vessel ; and therefore the particles of the blood becoming impervious from any cause, will stagnate in this part. If now we again consider, that these extremities of the vessels may be contracted many ways, the juices will there stagnate, and be incapable of passing through these narrow anastomoses. And from hence it is also evident, why the text contains the terms conical and cylindrical.

It was said before in the commentary on § 115. that the smallest particles of the circulating humours in animals, visible by the microscope, appear spherical ; and towards the last extremities of the vessels only one globule has been observed able to pass through at a time, and that even with some difficulty. From whence it is sufficiently apparent, that the anastomoses, or smallest extremities of the vessels, being contracted or diminished from any cause, will obstruct the free passage of the humours, by diminishing the capacity of the vessel ; since the bulk of the particles to be transmitted, does in this case exceed the diameters of the orifices through which they are to pass ; and therefore an obstruction must consequently arise, which is always an inseparable companion of inflammation, as is evident from the definition given of it in § 107.

But since (as was said in the commentary on § 109.) every section of our vessels, which is made perpendicular to their axis, is a circle, and as that figure has the greatest area of any that has equal sides ; it is from thence evident again, that every cause, which is able to change the figure of the vessels, may occasion a stagnation of the humours to be transmitted through the last extremities of the arteries. But of these causes the principal are those enumerated in this aphorism, many of which have been explained before.

Pressure, distraction, contortion.] Concerning these you may consult what has been said in the commentaries on § 112. numb. 1, 2, 3.

Rupture.]

Rupture.] The orifices of divided vessels naturally contract and obstruct the free course of the juices, which ought to flow through them, as was demonstrated in the commentaries on § 158. and 159. numb. 2 and 4. and it is also evident from what was there said on numb. 5. that a true inflammation may follow from that cause.

Contusion.] Since the idea of contusion includes an assemblage of small wounds, as was said on § 322. it is therefore evident from thence, why a stagnation of the humours is that way occasioned. Add to this, that a contusion always results from the pressure of some hard and obtuse body injuring the solid parts, which cannot be done without compressing or changing the figure of the vessels.

By burning, erosion, shrinking, *etc.*] For by all these ways a part is either totally destroyed, as by the action of fire or strong caustics, whence the living vessels in the margin of the disorder are obstructed; whence a stagnation and inflammation follow: or if the action of these causes is milder, by a contraction of the solids and an inspissation of the fluids, many of the vessels will be rendered impervious; from whence again the same disorders will arise, as we shall hereafter explain more at large when we come to treat of burns.

Heat.] That is when the degree of it much exceeds the heat of a person in health. But we shall hereafter demonstrate, when we come to treat of an increased heat as a symptom of fevers, § 689. that the solid fibres are therefore dried, contracted, and made rigid; but then the rigidity of the fibres, being increased, will augment the contractile power of the vessels which they compose, whence their capacities will be diminished, and an obstruction thence formed, as was demonstrated in the commentaries on § 113. If now it be also considered, that too great heat evaporates the most subtile parts of the fluids; and that after this the blood and its serum concrete
I into

into solid masses, hardly capable of being again dissolved; it will be from thence sufficiently apparent, that an increased heat is justly reckoned among the causes of inflammation.

Violent motion.] Consult what has been said in the commentaries on § 100. where it was proved, that an obstruction, inflammation, and all their consequences, may arise barely from an increased motion.

Foreign bodies in the flesh.] When any sharp pointed body is fixed in the flesh, it injures the vessels, and compresses those which are adjacent, while at the same time it causes a continual pain and irritation; from hence it is easily apparent, that an inflammation must from thence arise, especially when it is fixed in parts that are very sensible; for then the symptoms are seldom removed, till the injurious body is discharged by a suppuration made by nature. Ruysch^a gives us a remarkable instance of this kind in a girl, who swallowed a needle unknown to her parents; after which a hard inflammatory tumour was formed in the groin, accompanied with a violent fever and intense pain. This tumour was brought to suppuration by the application of emollient cataplasms, and being opened with a lancet, the needle was discharged rusty, with a considerable quantity of matter mixed with some of the intestinal fœces. This dangerous disorder was yet happily cured. But there are many observations, which teach us, that needles and other such sharp-pointed bodies may lie dormant for a considerable time in the panniculus adiposus without giving any great uneasiness. Thus I knew a turner, who had six years before a splinter of wood ran into the flesh betwixt his thumb and fore-finger; where it continued, and might easily be felt for so long a time without giving any great uneasiness or disturbance to him in his daily labour; and therefore he would never suffer it to be extracted by a surgeon, who notwithstanding told him the ill consequences that might

^a Observat. Anatom. Chirurg. n^o. 55.

follow. I likewise saw another instance which proves the same thing. A girl complained of a pricking pain about the arm: after a diligent examination of the part, I could not find any thing amiss, even by handling it all over; and she particularly observed, that the pain did not always trouble her, but only in some certain motions. I ordered the application of a galbanum plaister, and visited her again some days after: but as she found no relief from thence, in making a second and more diligent examination of the part, I felt something prick my finger, and afterwards perceived the sharp point of the needle sticking out through the injured skin. I extracted the needle with its thread, which was six inches long, by a pair of forceps; and then she presently recollected, that about six weeks before she had lost that needle while she was intent upon her work.

Ligatures.] These diminish the capacity of the vessels by compression; but they act more upon the veins than the arteries: since the former have their coats much weaker; and they likewise act more upon those veins which are placed in the surface of the body. But when ligatures are drawn very tight, they then compress the arteries as well as the veins. This is evident in the daily performance of phlebotomy; where, if the ligature is moderately tight, the blood runs freely from the incised vein: but if the ligature is drawn too tight, it compresses the artery likewise, and therefore little or no blood follows; but when the surgeon perceives this, he slackens the ligature and by that means promotes the efflux of the blood. See what has been said in the commentary on § 112. numb. 4. where we also gave a reason, why incumbent weights produce obstructions by compressing the vessels externally.

Acrid substances, either taken as food, or applied externally.] It seems to be a property of almost all parts of our body, whether external or internal, to contract themselves upon the application of any thing

acrimonious; and there are many experiments which prove the same thing. If a little drop of vinegar is sprinkled into the eye, the eye-lids are so strongly contracted, even against the person's inclination, that they require more than a small force to open them. And acrid poisons, taken into the stomach and intestines, occasion violent contractions in them; from whence, with the confined and heated air, great inflations arise. Upon applying a small drop of oil of vitriol with a probe to the naked intestine of a dog, I observed it immediately contract in the same manner, as if it was constricted by tying a ligature round it. It is therefore probable, that if acrid substances reach to the smaller vessels, they will likewise be brought into the same contractions, from whence follows an obstruction, which, joined with an increased circulation of the blood, may produce an inflammation. Thus when the blood itself is infected with an acid acrimony, it is observed to produce itchings, obstructions, pustules, and little ulcers about the cutaneous vessels, as was said at § 64. When the stagnating serum, which distends the legs of dropsical patients, begins to turn acrid, the skin is often inflamed. But if the force of the acrid substance is so great, especially when externally applied, as to dissolve the continuity of the vessels, it is sufficiently evident, from what has been before said, that then the inflammation may be produced in a much greater degree.

Severe cold.] It is evident from experience, that cold contracts the dimensions of all solid bodies; and therefore it must contract the capacity of the vessels. It was also proved in the commentary on § 117. that the particles of the blood cohere together by cold; and therefore by both these effects, cold may produce an obstruction and inflammation, and that in so great a degree, as to be often followed with a gangrene in a very little time, as we shall declare hereafter at § 454, 455. From hence too the reason may perhaps appear, why a pleurisy so frequently follows, when

when husbandmen indiscreetly expose themselves to the cold air when they return sweating from their labour: for the inspired and cold air comes almost into contact with the intercostal vessels, while only the very thin membrane of the pulmonary vesicles is interposed betwixt them; and at the same time the cold air increases the disorder externally, by being freely admitted to the body, which is not well covered.

Too much friction.] Of what efficacy friction is, in removing obstructions, was said before in the commentary on § 133. numb. 3. But when the friction has been continued too violently or too long a time, it may produce an ardent fever, even in the most cold and dropsical habits, as we explained it before in the commentary on § 28. numb. 2. For the motion or return of the venal blood being thus accelerated, the heart will contract more strongly and frequently, whence an increased motion of the circulation; which being too much increased produces an inflammation, as we demonstrated in the commentary on § 100. Thus we observe, that violent frictions make the parts of our bodies grow hot, red, swelled, and painful; but all these are the true signs of a present phlegmon, which will indeed soon go off if the friction is not continued too long, nor in too violent a degree: for when sailors on board a ship suddenly let the ropes run through their hands to slacken the sails against the wind, if they grasp them too firmly, a most violent attrition, heat, and pain thence arises in a moment, so as to raise the cuticle into blisters like those of a gangrene. If now we also consider, that by frictions the red part of the blood may be drove into many of the smaller vessels, into which it never enters in a natural state, (as is evident from the redness which accompanies almost every friction,) it will be still more evident, how an inflammation may be produced by too much friction.

All the causes of wounds, contusions, *etc.*] Concerning

308 Of INFLAMMATION. Sect. 375, 376:
cerning all these we have sufficiently treated before under those respective disorders.

S E C T. CCCLXXVI.

THE same stagnation is also produced, 2. by every thing which occludes the passage of the vessels, and applies an acrimony to them at the same time, whether externally or internally; such as substances which are both oily and saline, acrid, &c.

We know for certain, that the whole surface of the body, both external and internal, is perspirable; that is, a very thin vapour is expelled every moment of life through the smallest arterial ducts which open outwards; which vapour being condensed upon the polished surface of a cold looking-glass, or any other metalline body, forms a thin water, which afterwards entirely exhales without leaving any fœces. If now these ducts are by any cause obstructed, as through them the perspirable and very thin vapour ought to be expelled, those very minute vessels will be therefore dilated by the impulse of the confined humour; and being thus dilated, they may admit grosser juices, from whence an obstruction and stagnation consequently follow. But the least exhaling vessels being thus obstructed, those which are next in magnitude to them, not being able to discharge the thinnest part of their fluid into the exhaling vessels as before, they will be also dilated; and thus the disorder will be propagated from the smallest exhaling vessels even to the gross blood-vessels.

But as this exhaling vapour resembles water almost in every respect; and as oil prevents the entrance of water into very minute glass tubes, or at least renders the entrance of it more difficult, this may therefore be the reason why inflammations and an erysipelas so frequently

frequently arise from the external application of oil. Thus we read, that the bodies of the *athletæ* or champions were anointed with oil, that they might not be too much exhausted by sweat: and after bathing it was customary to use unction, to prevent the moisture from evaporating which had been acquired in the bath, and to prevent the native heat from escaping through the pores, which had been set open by the warm bath^a. In many people the skin itself is immediately inflamed by the application of a fat or oily unguent or emplaister: and something of the same nature seems to take place in the internal parts, since many people are inflamed or feverish soon after the taking of oily substances, and especially lard. If now these oily or fat substances also contain an acrimony, very obstinate inflammations may thence arise. Oil of almonds, which is so mild or sweet when it has been lately expressed, does by the summer's heat grow rancid in a few days time, and at length acquires so great an acrimony, that it inflames the fauces, though swallowed in but a very small quantity. The same is also true with respect to butter, which becomes rank either by long keeping or by frying in a pan. But an acrimony mixed with an oil or fat is the more prejudicial, because it most firmly adheres to the part to which it is applied, nor can it easily be washed off by watery liquors. The berries of the spurge laurel of the shops, (*Thymelææ lauri folio semper virente fructus*,) being pressed by the fingers, discharge a mere oil, which at first deceives the palate with a mild taste, but soon after it so much inflames the fauces, that when I unwarily tasted it, it almost suffocated me, insomuch that I was not able entirely to remove its troublesome acrimony, even by washing my mouth continually with a mixture of water, vinegar, and honey for the space of two whole hours. Thus also those caustic and empyreumatic oils, which are obtained by an intense fire from hartshorn, lig-

^a Hier. Mercur. de arte Gymnastica, Lib I. cap 8. pag. 36, 37.

num guaiacum, and the like, (which are often recommended for the cure of stiff joints and for dispersing impacted matter,) being imprudently applied to the skin, have been observed to occasion the most malignant inflammations, and sometimes even to produce a gangrene. For in these we find the greatest tenacity of oils, which obstructs the pores and small vessels: and this also combined with a violent acrimony, by which the irritated vessels are contracted.

S E C T. CCCLXXVII.

3. **E**VERY thing which causes the blood to concrete or cohere together; such as too great motion, a consumption of the thinner parts of the blood, by sweats, urine, spitting, or a diarrhæa; to which add every thing that coagulates the blood.

It was said in the history of obstruction, that it arose from the excess of the bulk of the transient matter above the capacity of the transmitting vessel; and that therefore the general causes were too great a narrowness of the vessels, or an increase of bulk in the particles of the fluid to be transmitted, or lastly from a combination of those two causes acting at one and the same time. In the two preceding aphorisms we considered the causes producing a stagnation in the smallest sanguiferous arteries, so far as it arose from a contraction of the vessels: but in this place we are to treat of those causes which make the blood cohere or run into such gross particles, that it cannot pass through the narrow extremities of the smaller arteries, even though their diameters or capacities remain the same. But among these causes the principal are,

Too great motion.] In the commentary on § 100 where we treated of the effects which follow from an increased

increased motion or circulation of the blood, as a cause, it was demonstrated that the blood acquired such a disposition by this increased motion, as rendered it more apt to concreate. For in the blood there is always a tendency towards concretion, which is the stronger, in proportion to the stronger action of the vessels upon their contained blood. For the blood of strong men taken from a vein immediately congeals, and after standing a while at rest, exhibits much cruor or crassamentum, and but little serum: the contrary of all which we observe in the blood of a weak girl. But all this depends on the more or less powerful action of the vessels upon their contained blood. But by an increased motion, the action of the vessels in a given time is more frequently and strongly repeated upon the contained fluids, by which means they acquire a greater condensation or compactness. Besides this by an increased motion the most fluid parts are dissipated; because a greater quantity of blood is applied in a given time to the organs which from thence separate and discharge the thinner juices: and from hence again the tendency of the blood to concretion will be augmented. Add to this, that an increased motion is followed by an increase of heat; from whence likewise the blood may be so inspissated, that it can be no longer able to pass through the narrow extremities of the smaller arteries. And therefore in acute diseases, when the heat is much increased, the injured function of the brain and the difficulty of respiration, immediately denote that there is such an inspissation of the blood that it can no longer pass freely through the narrowest passages of the smaller arteries in these viscera.

A consumption of the thinner parts of the blood by sweats.] We are taught by observation (as we mentioned before in the commentary on § 93.) that the grossest particles in the human blood are the red globules; but that there are a great many sorts of thinner juices interposed, by which the mutual contact and

cohesion of the larger globules to each other, are impeded. So soon, therefore, as this more thin and fluid part of the blood is drawn off by any cause, the larger globules will then come into contact, and being most strongly pressed together at the ends of the smaller arteries, they will there combine or concrete; from whence a stagnation of them, and an obstruction of the vessels follow. Thus when night sweats begin to waste a consumptive patient, the impervious blood begins to hesitate in the small vessels of the skin, and occasions inflammatory pustules. And for this reason it is that Hippocrates condemns sweats in the beginning of acute diseases: and Sydenham has observed their pernicious consequence when the patient has profuse sweats in the beginning of the small-pox.

Urine.] In hysterical and hypochondriacal disorders, there is often an incredible quantity of urine discharged, almost as thin as water, especially when the mind has been disturbed by any violent affection; but the blood being thus deprived of its diluting vehicle, its grosser parts begin to concrete, and sometimes occasions very malignant inflammations; or else the crassamentum of the blood is deposited about the abdominal viscera, where it usually produces the most obstinate obstructions. And from hence so often arises those hysterical or hypochondriacal passions, which are ascribed to the atra bilis.

Spitting.] If we examine the saliva which naturally flows from the mouth of a person in health, it appears sufficiently thin, (for the mucus of the fauces and adjacent parts being mixed with the saliva by the motion of the tongue, renders it more tenacious;) and by chemical analysis it appears to consist almost entirely of water; for out of sixty ounces of saliva, there may be almost fifty nine ounces drawn over by a gentle fire, which resemble water in all respects. The saliva also does not concrete with the heat of boiling water; from whence it appears to be thinner than the serum of the blood. A copious discharge by spit-

spitting will therefore drain off a great part of the thinner juices in the body, which the blood being deprived of, is by that means rendered less pervious or fluid. And for this reason, those who by an ill custom, or an abuse of tobacco, daily throw away large quantities of their saliva, are so frequently afflicted with the worst kinds of obstructions in their abdominal viscera. After all the internal parts of the mouth have been a long time covered with thick apthæ, when they fall off, an incredible quantity of saliva is discharged from the dilated vessels: insomuch that if the immoderate flux or spitting is not removed by proper remedies, the patient is often exhausted and killed, or else afflicted with chronical diseases for a long time afterwards; because the blood being thus deprived of its more fluid parts, produces incorrigible obstructions; nor is it any objection against us, that the blood does not become inspissated by a continual discharge of saliva in great quantities, continued often for several weeks together in a mercurial salivation: for in this case there is not a discharge of the saliva properly so called, but all the humours of the body, being dissolved into a putrid water by the action of the mercury, are this way evacuated: so that in this case the blood is not deprived of its most fluid parts, while the grosser parts are left behind; but even the red part of the blood itself undergoes a true dissolution; and therefore the patient may very well support this discharge, if the fresh juices of good aliments continually supply the place of the discharged humours.

Diarrhœas.] For this way likewise the thinner parts of the blood may be discharged from the body, as is sufficiently evident. Therefore Hippocrates in his *Prænotiones Coacæ*, pronounces a profuse diarrhœa to be fatal in an ardent fever: for since in this disease the blood begins to be impervious in the smaller arteries, by discharging the thinner parts of the juices, in a flux the disorder will be rendered incurable.

Which

Which coagulate.] Concerning these you may consult what has been said in the commentary on § 117.

S E C T. CCCLXXVIII.

TH E like disorder is occasioned in the lymphatic arteries, 1. by all causes which dilate their orifices wide enough to admit the grosser parts of the blood, which being drove further into these vessels, are stopped against their converging sides, and then the same consequences follow here as we explained before in § 377. that is, there will be dilatation of the vessel towards its origin, and a violent motion of the arterial humour behind the obstruction. 2. by all the causes which are commonly productive of other inflammations (375, 376.)

Hitherto we have considered those causes which obstruct the free course of the gross or red part of the blood through the smallest sanguiferous arteries: which causes acted either by diminishing the capacity of the vessels, or by rendering the blood itself impervious. But besides this, we also observe a true sanguine or red inflammation in those vessels which naturally exclude the red parts of the blood, by the smallness of their diameters. Of this we have a notable instance in the ophthalmia, in which the whole tunica adnata or white of the eye, and even the cornea itself look red, by a distention of their small vessels with the red part of the blood, to such a degree that they become visible to the naked eye, whereas naturally there was no red blood contained in those vessels. Such an inflammation must therefore have been preceded by certain causes, which put these dilated vessels in a condition to receive the red parts
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of the blood. Now it is evident, that the red parts of the blood being once entered into these smaller vessels, must produce an obstruction; since it will continually stop against the narrower sides of these converging vessels; from whence an obstruction arises, even tho' the capacity of the vessel remains the same, and the particles of the fluid which ought to be transmitted are not at all augmented. And this disorder is properly enough termed an obstruction (*per errorem loci*) by the blood mistaking its course; since in this case the red part of the blood stagnates, having entered the smaller pellucid vessels, and not being capable of passing through their smallest extremities; so that the whole essence of the disorder consists in the red blood escaping into other vessels. See concerning this what has been said in the commentary on § 118, where it was also proved, that this disorder may take place in every part of the body, in which there are vessels carrying a fluid thinner than the blood derived from the sanguiferous arteries. This disorder therefore, or error of place, can never be seated in the blood vessels, since we never observed any particles in healthy blood of a larger magnitude than that of the red globules; but it may take place in the several series of the other decreasing vessels. But how far this red part of the blood may penetrate into those vessels, is not as yet ascertained by experiment; but this we know, that in many diseases it often passes into vessels which are much smaller than those which contain the serum of the blood; as will appear evidently enough, if we consider, that it sometimes enters even the small vessels of the tunica cornea of the eye. But since all that fluid which is thinner than the red and serous globules of the blood, is generally denominated lymph; therefore those vessels through which the thinner fluid passes, are also termed lymphatics; and these are either arteries or veins. But it was proved in the commentary on § 119. that an obstruction cannot be seated in the veins, unless the

course

course of their fluids is intercepted by an external compression; and therefore the grosser particles of the blood can form obstructions by an error of place in the lymphatic arteries only; under which name we include all arteries which admit fluids whose particles are smaller than those of the red and ferous globules of the blood, refusing entrance to these last.

Therefore in order to form this disorder by an error of place, it is required for the mouths of the lymphatick arteries to be so far dilated that they may admit the red part of the blood. But it was demonstrated in the commentary on § 26. that the amplitude or capacity of the vessels depended on two different causes; namely, the resistance of their sides, and the momentum or force of the impelled fluid; and that therefore it was to be estimated in a ratio compounded of the impulse of the fluid directly, and of the resistance of their sides inversly. If therefore a greater laxity should from any cause arise in the beginning of the lymphatic arteries, the force of the impelled fluid remaining the same, they will be dilated; and on the other hand, the impulse of the fluids being increased, while the resistance of the sides of those vessels remains the same, it will produce the like effect; but this more especially when both these causes concur at the same time. See what has been said concerning the laxity of the vessels, as a cause of the blood's mistaking its course, in the commentary on § 118. But why the orifices of the vessels are dilated by an increased motion of the arterial fluid, was explained in the commentary on § 100. But what has been now said, is also confirmed by experiments; for any part of the body being exposed to the vapours of warm water, will swell and look redder than usual, from the ingress of the red blood into the smaller relaxed vessels. And after violent running, we see that the whole external skin looks red, and the eyes are in a manner suffused with blood from the entrance of that fluid into the smaller
pellucid

pellucid vessels, which are dilated by the greater impulse communicated to the fluids.

2. When once the red blood is entered into a lymphatic vessel, it is evident enough, that all those causes which are capable of diminishing the capacity of the larger or sanguiferous arteries, may produce the same effects, when applied to these smaller arteries. But of these we treated in the two aphorisms here cited.

S E C T. CCCLXXIX.

HENCE we see that the same disorder may take place in every conical vessel, in which the humours flow from a larger to a less capacity; for as in the red blood, so in the lymph; there are probably many parts grosser than the rest.

In healthy blood, which has been lately drawn from a small wound, and viewed by a microscope in capillary glass tubes, we distinguish several sorts of particles; and the same we are likewise able to discern in the pellucid membranes of living animals, in which the circulation of the humours through the vessels may be seen. For here we perceive globules swimming in a thinner pellucid fluid, in which last we can discover nothing farther, because the pellucidity makes the fluid appear homogeneous. But it seems highly probable, that in the thin or pellucid lymph of the blood, there are also some parts grosser than others, which by their determinate magnitudes, are contained in proportionable vessels, into smaller than which they cannot naturally enter. For unless the red globules were so large as to prevent them (in an healthy state) from entering the serous and smaller vessels; it is evident that all the blood would be derived into the smaller vessels, while the larger vessels

vessels would remain quite empty. The same is also true in those vessels which convey the serum of the blood, and in the several series of the smaller vessels. From hence when the blood becomes too fluid in diseases, it is either exhaled, or discharged out of the body by the emunctories, or is accumulated in the larger or smaller cavities of the body, as we observe in dropsies; but then the larger vessels always collapse for want of a sufficient quantity of the thicker part of the blood which used to distend them. Now the same thing seems to be true in the other decreasing series of the vessels, from the largest sanguiferous, down to the most minute exhaling ones; that is to say, every series of vessels have their proper and respective fluids, which are composed of such gross particles, that they cannot enter into the smaller vessels of the next succeeding order, but are confined each to their respective vessels. This being premised, if the capacity of these converging vessels is by any cause diminished, or the particles combined, which used to pass through the narrow extremities of those vessels, an inflammation may follow; but not a red one, as being seated in the smallest and pellucid vessels. Add to this, that if the orifices of the small vessels of the next succeeding order, are by a relaxation, or too violent a motion, so dilated as to admit the grosser particles of the next larger series of vessels, it must produce the like species of disorder (*ab errore loci*) by mistaking their place. There may be therefore as many different kinds of inflammations as there are different series of vessels, interposed betwixt those which are the largest and the smallest in the body; and they may be there produced two ways, either from a narrowness of the vessels, and an imperviousness of the fluids, from the largeness of their particles or else by an error of place, when the grosser particles pass out of the larger vessels into the dilated orifices of the smaller vessels. But in the largest or sanguiferous vessels,

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an inflammation can never be produced by an error of place, since there are no particles found in the blood grosser than those of the red globules. Whether or no the rheumatism, and gout of the joints and feet, arise from an inflammation of the smaller vessels, is a question concerning which you may consult what has been said in the commentary on § 122.

S E C T. CCCLXXX.

F R O M hence the true difference betwixt a phlegmon, erysipelas, œdema, and a scirrhus with an inflammation, is sufficiently apparent.

Phlegmon.] Though the ancients used this name for any kind of inflammation, yet it was afterwards customary (as we said in the commentary on § 370. from the authority of Galen and Ægineta) to apply this term only to a preternatural tumour accompanied with redness, resistance, heat, pulsation, and pain in some soft part, with a fever attending either in the whole body, or in the part itself. But this is occasioned from a stagnation of the red blood about the extremities of the arteries, whilst the rest of the blood acts with a greater impulse from the force of the heart and arteries, urging it forward behind the obstructions. A phlegmon may therefore arise either in the smallest extremities of the sanguiferous arteries, or, which is more frequent, it may be produced by an infarction of the red blood into the ferous or lymphatic arteries by an error of place. But it is evident by what has been said in the commentary on § 371. that the seat of a true phlegmon is most frequently in the adipose membrane.

Erysipelas.]

Erysipelas.] Galen ^c defines an erysipelas in such a manner, that it would seem entirely to resemble a true phlegmon; for he says, *Si ex sanguine et flava bile justo calidioribus fluxio mista fuerit, aut ex sanguine quidem, sed fervido, et substantia tenuissimo, erysipelas vocatur ille affectus, multo calidior inflammatione, et aspectu flavior. Et si tetigeris, sanguis facile subfugit, rursusque affluit, exquisite tenuis et ruber apparens. Non tamen similiter dolet erysipelas ac inflammatio: neque secundum ullam inflammationis speciem aut pulsum, aut compressionem, aut distensionem similem adfert. Verum aliquando moderate omnino infestat, et maxime, quando circa solam cutim dispersum est, minime lædens subjektam carnem. Et plerumque tale fit, et illud est exquisitum erysipelas;* “ If a fluxion or congestion arises from a
 “ mixture of blood and yellow bile hotter than usual,
 “ or even from hot blood alone much attenuated, the
 “ disorder is termed an erysipelas; which has a much
 “ greater heat than an inflammation, and a yellower
 “ aspect. If you touch or press it, the blood readily
 “ disappears, and again returns, appearing very thin
 “ and florid. But yet an erysipelas is not so painful
 “ as an inflammation, nor is it like any kind of in-
 “ flammation accompanied with a pulsation, resist-
 “ ance, or distention. Even sometimes it appears
 “ very moderate, and especially when it is spread on-
 “ ly about the skin, without at all injuring the sub-
 “ jacent flesh; as it most generally does, and is then
 “ a true erysipelas.” And a little after he adds, *Exquisitum erysipelas solius cutis affectus est;* “ That a
 “ true erysipelas is a disorder of the skin only.” But as the part invaded with an erysipelas appeared of a yellowish red colour; therefore the antient physicians accused the bile as the principal cause; but we at present know that the serum of the blood is naturally yellow, so that if a little cruor stagnates with much serum in the pellucid vessels, which are obstructed

^c Lib. II. Meth. Med. ad Glaucon. cap. 1. Charter. Tom. X. pag. 368, 369.

and inflamed, the affected part will then appear of a reddish yellow colour. Hence also appears the affinity which is betwixt an erysipelas and a phlegmon, since they only differ in the magnitude of the obstructing particles: for in a phlegmon the red part of the blood is accumulated in the obstructed and distended vessels, but in an erysipelas, the serum of the blood mixed with a little cruor, becomes impervious in the same manner: also the seat of a phlegmon is chiefly in the membrana adiposa, whereas an erysipelas invades either the external integuments of the body, or the internal membranous parts. And from hence also it appears, that an erysipelas may degenerate into a phlegmon, from the dilating vessels admitting a larger quantity of the red blood, and spreading the disorder into the adipose membrane: also that sometimes an inflammation may arise, as it were betwixt an erysipelas and a phlegmon, in which case the ancient physicians termed the disorder by a name compounded from both of those affections. For soon after the passage, which we lately cited from Galen, he adds^b, *Quemadmodum id, quod subjectam carnem attingit, neque ex tenui omnino fluxione fit; non solum erysipelas est, sed mixtus affectus ex erysipelate et phlegmone, in quo quandoque propria erysipelatis symptomata prævalent, et à recentioribus medicis vocatur talis affectus erysipelas phlegmonodes; quandoque autem phlegmones, et dicitur ideo phlegmone erysipelatodes. Quod si neutrius (symptomata) evidenter prævalent, sed æqualia videantur, phlegmonen et erysipelas mista esse dicuntur;* “ That
 “ an inflammation, which extends to the subjacent
 “ flesh, and does not arise entirely from the afflux of
 “ a thin humour, is not a simple erysipelas, but a
 “ mixt affection from an erysipelas and a phlegmon,
 “ in which sometimes the proper symptoms of an
 “ erysipelas prevails; and then this disorder is by the
 “ more modern physicians called a phlegmonode ery-

^b Lib II. Meth. Med. ad Glaucon. cap. 1. Charter. Tom. X. pag. 368, 369.

“*ſipelas*; ſometimes alſo *phlegmons* prevail, and are
 “ for this reaſon called *eryſipelatode phlegmons*. But
 “ if the ſymptoms of neither of theſe appear to pre-
 “ vail, but ſeem to be equal, the diſorder is ſaid to be
 “ a *phlegmon* and *eryſipelas* mixed.”

[*Œdema*.] The word *Οἰδημα* ſimply ſignified a tu-
 mour, as was ſaid in the commentary on § 112.
 numb. 1. but in proceſs of time this name was un-
 derſtood generally to mean a ſoft tumour without
 pain, and eaſily yielding to the touch without an al-
 teration in the colour of the ſkin, which tumour ge-
 nerally ariſes from watery humours diſtending the cel-
 lular membrane. But the *œdema* of which we here
 ſpeak is of a very different nature, being generally deno-
 minated *œdema callidum* to diſtinguiſh it from the for-
 mer. It was demonſtrated in the commentary on
 § 379. that a true inflammation might ariſe in the
 arterial veſſels, which, by their minutenefs, exclude
 the red and ſerous parts of the blood. A tumour
 therefore, which is painful, hot, and not red, but yel-
 lowiſh, or ſometimes even white, is to be called an
œdema callidum; which only differs from an *eryſipelas*,
 in that the ſeat of the diſorder is placed in much
 ſmaller veſſels. It is ſometimes alſo called an *eryſipe-
 latous œdema*, inaſinuch as it often nearly approaches
 an *eryſipelas*. It is frequently obſerved in the head
 and face, and is commonly termed the *gutta roſacea*.
 Some ſigns of this *œdema* are to be met with in Ga-
 len^c; for though he aſſerts that any kind of tumour
 may be called by this name, or rather that it might
 be more particularly applied to cold tumours properly
 ſo called, yet in treating on the cure of an *eryſipelas*,
 whether ſimple or compounded with other diſorders,
 he ſays, *Quemadmodum autem ſæpe phlegmonæ admisce-
 tur Eryſipelas, ita etiam aliquando œdemati: ac vocetur,
 quod ex ambobus tum eſt conflatum, Eryſipelas œdemato-
 ſum*; “ But in the ſame manner as a *phlegmon* is of-
 “ ten compounded with an *eryſipelas*, ſo an *eryſipelas*

Meth. Med. Lib. XIV. cap. 3, 4. Charter. Tom. X. pag. 321.

“ may be sometimes mixed with an œdema, and may
 “ be denominated, as being compounded of both,
 “ an erysipelas œdematosa.” But that he did not under-
 stand the case, in which the skin of the parts dis-
 tended by a cold tumour became erysipelatous, is suf-
 ficiently evident from what he subjoins in the follow-
 ing chapter, where he says, *Quemadmodum autem ex*
biliosa fluxione erysipelas, ita ex phlegmate fit œdema,
rarus quidam ac indolens tumor. Equidem scio aliter
quoque œdemata provenire circa pedes in hydropicis af-
fectionibus, phthisibus, aliisque pravis, qui vehementes
sunt, habitibus. Atque in illis quidem œdema plenitudi-
nis hominem prementis est symptoma, nullam seorsum pro-
priam curationem requirens, &c. “ But in the same
 “ manner as an erysipelas arises from a bilious afflux,
 “ so an œdema may arise from phlegm, which is
 “ then a soft and indolent tumour. I am indeed not ig-
 “ norant, that an œdema may also arise in another
 “ manner about the feet in dropical disorders, in
 “ consumptions, and in other violent depravations
 “ of the habit; and in these indeed the œdema is a
 “ symptom of the plenitude which oppresses the pa-
 “ tient, requiring no particular or distinct treatment,”
 &c. But although he calls it an indolent tumour
 from his preconceived opinion, that it arose from pi-
 tuita, yet it is very evident from the remedies which
 he recommends for the cure of this œdema, that it
 was rather of a hot than of a cold disposition; for a
 little afterwards he adds, *At si ex pituitoso humore in*
partem influente œdema constitit, abunde aliquando satis-
facit spongia sola, quæ ex aqua, in qua sit aceti aliquid,
maduerit, &c. “ But if the œdema proceeds from the
 “ afflux of a phlegmatic humour into the part, the
 “ cure will be sometimes fully accomplished only by
 “ a sponge, which has been moistened with vinegar
 “ and water,” &c.

Since therefore this œdema callidum has a true
 inflammation seated in the smallest lymphatic arteries,
 there will be always danger in this case, that the thin

lymph of the blood may acquire such a cohesive disposition, as may render it impervious and apt to obstruct its small vessels; from whence the functions of the brain especially may be disturbed, as they depend on a free circulation of the finer humours through the smallest arteries, whether this disorder be originally formed either in the encephalon, or by a translation from some external part inwards. Add to this, that if the disorder is violent, the smallest vessels being destroyed may incline the parts to a sudden gangrene.

Scirrhus with inflammation.] A scirrhus is a hard and unequal tumour, with little or no pain, seated chiefly in some glandular part. If it be confirmed or inveterate, it consists of such a matter as appears incapable of being dissolved by any artifice, with which we are as yet acquainted, nor can it ever be separated from the sound parts by a mild suppuration. From whence it is evident how dangerous an inflammation is, when seated near a scirrhus, or when fixed in the integuments which invest a scirrhus, as it may then soon degenerate into a cancer, as we shall explain more at large hereafter, when we come to treat professedly on a scirrhus. Galen^d has very well distinguished the hardness of a scirrhus from the resistance of a phlegmon, when he says, *Phlegmone namque non durum (σκληρόν) sed resistentem tumorem efficit (ἀντίτονον) perinde atque utres sunt liquida materia aut aere pleni*; “For a phlegmon is not hard, but occasions a resisting tumour only in the same manner as when bladders are filled with any liquor or with air.”

^d Comment in Textum XXX. Epidem. Hippoc. Lib. VI. Character. Tom. IX. pag. 389.

S E C T. CCCLXXXI.

BUT so often as these causes (375, 376, 377, 378, 379,) have produced this stagnation (371, 372, 379,) in the small vessels (372, 373, 374, 378, 379), then the blood, moved by the remaining *vis vitæ*, produces certain effects or symptoms, which are at the same time the proper signs of an inflammation.

Two causes are observed to occur in every inflammation seated in any series of the arteries; namely, either an imperviousness of the fluids occasioned by a narrowness of the vessel, or a concretion of the particles, or else lastly, from their mistaking their course (*errore loci*;) and the propelled humours being at the same time urged forwards with an increased velocity into the impervious vessels by the *vis vitæ* acting behind them. If these concur, an inflammation is present; but if there is only an imperviousness of the fluid, it affords the idea of obstruction: which last is therefore the predisposing or proegumenal cause of inflammation, while the procatartic or accessory cause is the increased motion urging on the back of the obstruction. But while these causes act, certain changes are produced in the inflamed part, which, being observed, afford the true diagnosis of a present inflammation; but of these we are to treat in the following aphorism, in which they are enumerated in their proper order.

S E C T. CCCLXXXII.

1. **T**HE minute and scarce visible obstructed arteries are now enlarged by the distending blood, and from hence a red tumour. 2.

The arterial lymphatic vessels, which were before pellucid and invisible, do also suffer the same distension and alteration in colour; and from hence an increase of the redness; and especially this, when the very small vessels and vesicles in the panniculus adiposus are stuffed full of thick blood, deprived of its more fluid parts. 3. The small vessels being so far distended as to be near upon breaking their smallest fibres; from hence follows a pricking pain. 4. The solids and fluids are both violently compressed or compacted together, and from hence a hardness and resistance in the part. 5. From an accumulation of the red blood which is violently impelled into the vessels, arises a shining redness. 6. From the resistance, pulsation, compression of the vessels as yet pervious, but made narrower by the enlargement or dilatation of those which are obstructed; thence arises a violent attrition of the parts of the juices against each other, and against the solids, as also of the solids against them; and from hence follows the heat or burning of the part. 7. Because the blood impelled from the heart does by the force, which it acquires from that muscle, dilate the sides and extremities of the obstructed vessels; from hence follows a pulsation. 8. From an irritation of the fibres, and a swifter course of the blood through those vessels which are open, (since it is returned by the veins, but obstructed in many of the arteries;) from thence arise a quick pulse, fever, thirst, heat, watchings, weakness, and uneasiness.

1. It was demonstrated in the commentaries on § 120. where we treated of those effects which followed

lowed from obstruction as the cause, that the obstructed vessels were of necessity extended or dilated. For that force, with which the hearts propels the blood into the arteries, causes their sides to recede from the axis of the vessel, since they are full, and gradually converge, or become narrower. The resistance therefore at the extremities of the arteries, and their fulness, are the principal causes why they are dilated by the impulse of the blood: but in obstructed vessels there is the greatest resistance and at the same time the greatest fulness, since nothing can be transmitted through their extremities; a great dilatation of them must therefore of necessity follow. If now we also consider, that an inflammation is accompanied with an increased motion of the blood, it will evidently appear, that the vessels must be more largely extended when there is an inflammation, than when they are barely obstructed. But when this dilatation is made in those arteries which naturally convey the red blood, or which admit the blood when they are dilated by disease, it is evident, that the tumour formed by that distention must appear red: for if an obstruction or inflammation is seated in the smallest vessels, they may be in the utmost distention which they are capable of bearing without a rupture, and yet may they exclude the red part of the blood, as we said at § 379, and 380. Even this disorder may be conceived to reside in vessels so extremely minute, that even the tumour resulting from their dilatation may be too small to come under the observation of our senses. But concerning this see more in the commentary on § 122. But a true inflammation, properly so called, is always seated in those vessels, which either naturally contain the red blood, or which are capable of receiving it when dilated, as is evident from the definition given of it at § 371.

Besides this the increased heat, which accompanies every inflammation, makes another addition to the bulk of the tumour, as will be presently demonstrated

ted at numb. 6. for it appears from certain experiments, that all bodies expand throughout all their dimensions by an increase of heat.

2. A ferous artery is derived from the least sanguiferous artery, in the same manner as a branch is derived from its trunk; but the sides of the sanguiferous arteries cannot be distended without distracting and enlarging the orifices of the ferous arteries which arise from them; from whence the red part of the blood may enter through their dilated orifices. The same is also true with respect to the lymphatic arteries, which are derived from the ferous arteries: for that these may be so distended, as to be capable of receiving the red part of the blood, is apparent in ophthalmias or inflammations in the eyes, as we said a little before. From hence therefore will manifestly follow an increase of the redness of the tumour. But neither is all this seemingly sufficient to produce such enormous tumours as are frequently observed in violent inflammation. Now we demonstrated in the commentary on § 374. that an inflammation fixes itself in no part more frequently and firmly than in the fat, when the small vessels of this membrane are stuffed up with impervious blood, and discharged through the orifices of the vessels which open into the cells of the membrane; from whence this adipose membrane, which is so easily dilatible, is often distended in a surprizing manner. Galen^a has very well observed this cause of the tumour in a phlegmon; for after having said that no tumour can arise without the accession of new matter to the swelled part, or without a dissolution of the parts by the violent heat, so as to pass into air, which might distend the part into a larger bulk; as for example in the same manner as water being rarified by heat into vapours, occupies an immense space: but he proves that the tumour in a phlegmon does not arise from this rarefaction of the

^a De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 313.

juices, so as to dissolve them into vapours of air; for says he, *Apparet enim, si secta fuerit pars phlegmone laborans, sanguis effluens plurimus, et locus univ ersus sanguine plenissimus, quemadmodum spongiæ mardentes; spiritus autem neque statim excidit, neque postea;* “ For it appears, that if the part afflicted with a
 “ phlegmon be laid open by incision, much blood
 “ flows from it, and the whole part seems extremely
 “ full of blood, in the same manner as sponges full
 “ of water, but no air or spirit is discharged either
 “ immediately or any time after.” And in the end of the same chapter he adds^d, *In inflammationibus autem omnia sanguine replentur, ex vasis per eorum tunicas resudante, in omni vero carnis parte roris instar permixto;* “ But in inflammations all the parts are filled
 “ with blood, transuding through the coats of their
 “ vessels, so as to mix like dew with every part of
 “ the flesh.” But by flesh Galen understands the tunica adiposa, as is evident from what was said in the commentary on § 374. as also from many other passages in his writings. For in the chapter lately mentioned he carefully observes, that a tumour, which accompanies an inflammation, is very different from that which arises from an increase of the habit of body; making use of the word *πολυσαρκίας*, to denote a greater obesity.

But when the red part of the blood enters the smaller dilated vessels, it there mixes both with the serum and thinner lymph contained in those vessels; but here the red part only of the blood remains impervious, being wedged into the narrowest parts of the converging vessels, while the more fluid parts will be carried off by the lateral vessels, which open betwixt the obstruction and the pressure which urges behind; and from hence the red part only will be more and more accumulated in the obstructing vessel, which

^b De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 315.

will again prove another cause increasing the redness in the inflamed part.

3. Since therefore the vessels are distended by the impulse of the humours urged on behind the obstructing matter, from hence their coats, and consequently the nervous fibres dispersed through them, will be distracted; which will excite pain, as is evident from what has been said in the commentaries on § 220, and 224. numb. 2. But since the largest vessels which are interposed betwixt the sanguiferous and the smallest arteries, (namely, the smallest extremities of the arteries which convey the red blood) does not equal in thickness the tenth part of a hair of the head, it is evident, that the distraction of the nervous fibrillæ dispersed through the coats of such a small vessel, must excite a pain, as if in a single point of the body only; and from hence the pain is said to be pricking. But one of these smallest sanguiferous arteries is yet much larger than either the serus or lymphatic; though even in these, there is a like distraction and pain produced in a point still less. So that a hundred of these small vessels being inflamed, will cause a pain as if it was fixed in a single point; only because the impulse of the humours behind the obstruction so distends the vasculæ, that the nervous fibres constituting their sides, are in danger of breaking. And from hence it is that when so much blood is drawn from a vein in a violent pleurisy, that the patient faints away, the pain either intirely vanishes, or at least is much diminished.

4. Our blood when at rest separates into two parts, the one a red concrete, and the other a watery serum, in which the red part swims. But there are two principal causes in the body which prevent this concretion; namely, a continual motion, and the interposition of a thinner fluid betwixt the red globules, by which they are removed from their mutual contacts. But when this red part of the blood stagnates in any of the sanguiferous vessels, or becomes impervious in any
of

of the smaller dilated vessels, its more fluid parts are expressed, as we said before at numb. 2. under the present aphorism, from whence follows a compression, and a combination of the red globules with each other, and as they are flexible, their spherical figure will be flattened, and they will touch one another in more points, and by that means begin to cohere more strongly. These causes therefore continuing, the red globules will be accumulated in the much distended vessels, as also in the cells of the tunica adiposa; and from hence a greater hardness and resistance of the inflamed parts will necessarily follow. But as vessels thus distended compress those which lie next to them, the capacities of these last being thus diminished will propagate the disorder through the whole inflamed part. For this reason Hippocrates often places hardness and pain for an inflammation. Thus in his prognostics^c, in treating on an inflammation of the bladder, and the consequences, which thence follow, he says, *at vesicæ duræ et dolentes, &c.* And in other places, as Hollerius^d remarks, he distinguishes a phlegmon from other tumours by the hardness and pain.

5. The thinner parts of the juices being expressed, leave only the red parts of the blood accumulated in the distended vessels; whence (*cæteris paribus*) the redness is also much the greater, in proportion as the inflammation is more violent. But the skin being in most parts of the body loose and moveable, is very much distended by the impervious blood stagnating in the adipose membrane, insomuch that it shines with a smooth surface; for the tense skin always shines, as it is said to do in fat people, being distended by the accumulated fat. Thus the well fed dog was asked by the lean wolf from whence he shined with that fatness^e. And we daily observe, that the tense skin

^c Sentent. 71. Charter. Tom. VIII. pag. 659.

^d Comment. in Coac. Prænot. Hippoc. pag. 552.

^e Phædr. iii. 7.

looks beautifully smooth and shining in young people, whereas in old age it is beset with ugly wrinkles.

6. We are assured from certain experiments, that the most intense heat may arise barely from the attrition of bodies against each other, and even that actual fire may be by this way produced. (See our chemistry, vol. i. pag. 176.) It has been also proved that the heat arising from this attrition is so much the greater in proportion as the bodies are more rigid and elastic; and also that it increases in proportion as the bodies are more forcibly pressed against each other, and as they are more swiftly agitated^f. But it is certain that water or any other liquor being interposed between the bodies while they are rubbed against each other, prevents the heat from becoming so intense, as it will when there is no such liquor interposed; from whence it would seem, that heat cannot easily arise from the attrition of our fluids against the sides of their containing vessels. But if we consider that the globules of the blood are elastic, and also moved very swiftly through elastic vessels, which converge in such a manner, that in the ultimate extremities of the sanguiferous arteries, hardly more than a single globule can pass through at a time; and that therefore the more thin parts of the juices being carried off by the lateral branches, the largest globules will be strongly pressed and rubbed against the sides of the vessels; from hence it is sufficiently evident that heat must arise from this attrition; so that in strong people who have a thick blood, a greater heat is usually observed. But when the blood, being dissolved, inclines more to the nature of inelastic water, the heat is always observed less, and for the same reason a greater heat always accompanies a swifter motion of the blood through its vessels. Nor is it any objection to this, that the impervious blood

^f Videatur de his omnibus Boerhaavii Them. Tom. I. pag. 176, &c.

stagnates in the obstructed vessels of the inflamed part; since it appears from the experiment of Lewenhoeck, alledged in the commentery on § 132. that such impervious particles of the blood are repelled back by the contraction of the artery, at the instant when the heart does not act, and that soon after they are again propelled to the obstructed part of the artery, while the blood is sent forward by the systole of the heart; whence it is evident that thus the obstructing particles may run forwards and backwards in the same vessel. But since it appears from what has been said before, that the thinner juices are continually expressed, while the gross and impervious particles of the blood are accumulated and condensed, while the velocity of the blood's motion is also augmented through the inflamed part, the reason will be evident, why such a considerable increase of heat must necessarily follow. But the adjacent vessels which are not yet obstructed, will be compressed and made narrower by the distention of the inflamed vessels; whence will follow a greater attrition of the compressed vessels, partly from a diminution of their capacity, and partly from the increased velocity of the fluids to be transmitted. For if out of an hundred vessels, fifty of them are obstructed, the blood must then pass as swift again through the fifty which remain pervious. Every circumstance therefore concurs in an inflammation from which we are assured by experiment a greater heat may arise. For the blood being deprived of its more fluid parts, concretes almost into a solid mass, which is every moment condensed more and more by the violent action of the vessels, and the impulse of the humours acting behind: the vessels compressed by those which are distended, will be applied more strongly to their contained humours, and the motion of the fluids through the vessels will be in general accelerated. From hence the reason appears why an inflammation does by the similitude of its causes and effects derive its name from fire, as was said before: § 370.

7. Since the whole body is found, by the modern anatomy, to contain arteries dispersed throughout almost every point of it; and that all these arteries are dilated at one instant of time, while the heart is in its contraction, and that they are again contracted the moment following, while the heart is in its dilatation; it will be evident, that almost every point of the body receives a motion of pulsation every moment of life. But we do not naturally take any notice of this motion; even though it is very strong, and always performed in our bodies by the same laws; but so soon as this motion exceeds its usual bounds, we presently perceive it. Thus the strong pulsation of the heart, which may be so easily perceived by applying the hand to the breast, is not at all felt by a person in health; but so soon as it exceeds its due motion by passions of the mind, a violent motion of the body, &c. then the heart is perceived immediately to palpitate. It is no wonder, therefore, that a pulsation should be perceived in the inflamed part, which was not observed in it before; for the blood thrown into the obstructed arteries by the force of the heart, will spend all its force in removing the sides and extremities of those arteries; and from thence the sides of the arteries will recede farther from their axis, and when the force of the heart ceases, they will return or contract again with so much a greater force, in proportion as they were more distended. The pulse will be therefore thus increased in the inflamed part, and being raised in strength and velocity beyond its natural action, it will be very distinctly perceived.

8. When the ends of the arteries are obstructed, the humours contained in the veins, corresponding to those arteries, do nevertheless return to the heart; but being afterwards propelled by the heart, they cannot pass through the obstructed arteries, but must run with so much a greater velocity through those arteries which remain pervious. For, in this case, the
quan-

quantity of humours to be transmitted through the vessels, is not diminished, though there is a less number of the pervious or transmitting vessels; from whence it is sufficiently evident, that the blood must pass with an increased velocity through the other vessels which remain pervious. But, at the same time, it is also from hence apparent, that this cause will not be sufficient to increase the velocity of the humours, so as to render it sensible to the physician, unless the affected part is so large, that the number of its impervious vessels will make a considerable difference, when compared with those that remain open: for if a thousandth part of the arteries are thus obstructed by an inflammation, the increased velocity required to move the blood through the rest of the open vessels, seems to be scarce within the reach of observation. Another cause is therefore necessary to account for the frequent attendance or following of a fever after an inflammation; which fever we frequently observe, even when the inflammation is seated in but a very small part of the body: for thus a very violent fever often attends, when an inflammation is seated in but a very small membrane; as, for instance, in the paronychia or witloe. Therefore it is added in the text, from an irritation of the fibres. When we treated of the effects of pain, in the commentary on § 226. it was demonstrated, that a fever might arise from pain only; and for the same reason a violent fever so frequently accompanies the most painful inflammations: whereas an inflammation is not often attended with a fever, when there is little or no pain; whence it follows, that the fever seems to arise chiefly from the irritation of the nervous fibres dispersed through the inflamed vessels and membranes, which are too violently stretched or pressed. That there is in reality such a power or disposition in our vessels, as renders them liable to irritation, whereby the circulation of their humours is accelerated, we are taught by many observations.

When

When the offending matter is dissolved in acute diseases, it flows through the vessels, and is often translated or settled upon some other part, or else it is discharged from the body by critical evacuations; and in these changes, what wonderful disturbances frequently arise in the body? and in what a surprizing manner is the pulse often accelerated and discomposed? When the chyle, which is made from too large a quantity of aliments, or from such as are more compact or acrimonious than usual, comes to circulate with the blood through the vessels, it produce a fever; but of this we shall treat hereafter, in the history of fevers; and it may be at present sufficient for us, only to observe this in general, in order to shew, that an irritation of the fibres may produce a fever.

But the signs of a fever attending, are the appearance of its chief symptoms; thirst, heat, watchings, *etc.* of which we shall treat particularly in their proper places. But it is to be observed, that these symptoms do not attend every inflammation, but only when the whole mass of blood has acquired such an inflammatory spissitude, that it cannot easily pass through the smallest vessels. For it appeared before, that in healthy blood there is naturally an inclination to concretion, and the more, as the patient was of a stronger habit: but so long as this tendency to concretion can be overcome by the action of the vessels in the viscera, so long will the patient survive. But we see daily in acute diseases, that the blood is so much altered that at length it scarce retains its fluidity; it immediately congealing if not prevented by the frequent action or attrition of the vessels. Thus the blood which drops from the nose in ardent fevers immediately congeals into a solid mass; insomuch that often this thick blood stops up the small arteries which were opened by nature to make a salutary discharge, in order to terminate the disease. Hence Hippocrates § justly condemns these small discharges ○

blood, in his Prænotiones Coacæ; and in another place^h, he gives instances of three patients, proving the fatal event, when this discharge of blood from the nose was very small on the fourth and fifth day. When therefore this inclination of the blood to concretion is augmented, it is sufficiently apparent, that it will meet with more difficulty in passing through the smallest arteries; from whence will arise a greater resistance to the heart: and since the lungs ought to receive and transmit the blood, which it immediately receives from the right ventricle of the heart, through the smallest extremities of its pulmonary artery; therefore the least inclination of the blood to run into cohesions will be perceived in the lungs, whence again the respiration will be increased, in order to protrude the blood more forcibly through the lungs. Thus arises that uneasiness or anxiety, which is a bad sign in all acute diseases, and especially in the inflammatory; that is, the respiration becomes laborious and difficult, and the patient declares his anxiety and uneasiness by continually changing the posture of his body. This is the *δυσφορία*, or hesitation of the blood, as it is called by Hippocrates, which though it may be the consequence of other causes (as will be hereafter declared in § 631, et seq.) does yet more frequently proceed from an imperviousness of the blood.

It is therefore evident, from all that has been said under this aphorism, that a phlegmon is known by these signs, to be a red tumour, tense and shining, with a pricking pain, heat, and pulsation, accompanied with a fever, either in the whole, or at least in that particular part of the body.

^h Epidem. I. Textu 63. Charter. Tom. IX. pag. 65.

S E C T. CCCLXXXIII.

AND this is the state (382) of a phlegmon before the disorder has arrived to its full height.

All the signs enumerated under the preceding aphorism are observed in a phlegmon, which is increasing, but has not yet arrived to its full height: for there are three stages observed by physicians in all diseases; namely, their increase, height or state, and their declension. Their increase is said to be as long as all their symptoms grow worse; and the state or height of the disorder, is, when the symptoms are arrived to their greatest degree of malignity, and do not afford any sensible signs of their augmenting or diminishing; but the declension of the disorder is when the violence and number of the symptoms gradually diminish. Thus when a phlegmon has arrived to its full height, it then begins to be disposed to terminate either by resolution, which we call health, or into some other disease, as an abscess by suppuration, a gangrene, a sphacelus, a scirrhus, *etc.* as we shall presently declare more at large. But at the time of change, many of the signs or appearances which accompanied the phlegmon as not yet adult, are considerably altered, or else removed, and other new signs appear, which were not to be observed before: Thus, for instance, the redness, tension, pain, and hardness, which are observed in a phlegmon, begin to diminish when it tends to a gangrene, and at length they even quite vanish, and are, on the contrary, succeeded by an insensibility of pain, a pale ash or brown colour, flaccidity, pustules full of ichor, *etc.* These stages are therefore to be carefully distinguished, as well in a phlegmon, as in other diseases, in order to determine

determine any thing with certainty in relation to the diagnosis, prognosis, and curative indications.

S E C T. CCCLXXXIV.

IF now blood be drawn, in a full stream from a larger orifice in a vein, into a basin; as it grows cold, it forms a white, hard, thick and tough skin, almost like the skin of pork.

When blood is drawn from a person who has a violent inflammation, it affords an appearance surprising enough. It is well known, that the blood congeals sometime after it has been received from the vein, and stood still in a basin; and that it then separates into two parts; the one a thin yellow coloured liquor, and the other a red concrete, usually swimming in the former; which last is usually termed the crassamentum. But in acute, and most of the inflammatory diseases, the upper surface of the crassamentum appears covered with a white or light bluish coloured skin, which is frequently several lines thick, and is sometimes so tough, and firmly adhering to the crassamentum, that it with difficulty admits of being divided, even by a razor. As this tough skin is almost constantly observed in the blood of those who are afflicted with a pleurisy, therefore when physicians see the same appearance in the blood extracted in other diseases, they term it pleuretic blood, though it is not restrained to a pleurisy only. There are several observations more than a little surprising, to be met with in authors concerning this appearance; thus Sydenham^a has remarked, that if the blood does not flow in a direct or horizontal stream, but runs trickling down over the skin, that then this tough crust will not appear on the surface of the blood, even though it flowed fast enough from the orifice; and

^a De Pleuritide, pag. 333, 334.

he ingenuously confesses himself ignorant of the cause of this difference. He has also observed, that the patient is not relieved by that manner of bleeding as he is when the blood runs in a full stream, and appears covered with this crust; and he takes notice, that any other obstacle which impedes the free exit of the blood from the orifice of the vein, will also hinder the generation of this crust or skin, and occasion the patient to be less relieved by it. But what is still more wonderful, it has been observed that this skin will not be formed, even though the blood has been drawn in a full stream from the vein, provided it is but stirred round with the finger: Therefore the origin of this crust appearing on the surface of the venal blood, seems to be very obscure. But whether or no it is produced from the serum of the blood, inclined by disease to a greater degree of cohesion, is what may be questioned; though it is certain that it always occupies the surface or upper part of the crassamentum, which swims in the serum. Whether or no is it formed of the crude chyle, not yet converted into the blood? This is the opinion of the acute Simson^b, but it seems to be an objection to this, that the chyle mixed with, and not yet converted into the blood, must swim in the serum, and not cohere to the crassamentum. The same author observes, that if a strict ligature be made about the arm or thigh, and a vein be opened three or four hours afterwards, so as to let the blood flow out in a full stream, that then this skin will always appear; as it is also constantly found in the blood of women with child. Whence he places the cause of it in the remora or stagnation which the blood suffers in the vessels, obstructed sometime by ligatures, or by the pressure of the uterus in gravid women; or at least because it is moved more slowly. To speak the truth, I must confess myself in a doubt what to think concerning this tough skin, which always most firmly

^b De Re Medica Dissert. quatuor, pag. 112.

Sect. 384, 385. Of INFLAMMATION. 341

adheres to the surface of the crassamentum. It is the opinion of many learned and eminent physicians, that this crust is formed while the blood is more inspissated and inclined to concretion by an increased velocity of its motion; and therefore they judge it to be rather an effect or consequence than a predisposing cause of the disease. But I have frequently observed, that such a crust has appeared in the blood of the most healthy people, who open a vein every year in the spring; and even in a weak man, who bled every three months to prevent an hæmorrhoe: in which cases there was therefore such a disposition of the blood, even though there was no inflammation; and on the contrary, no such crust has been observed in some of the most violent inflammatory diseases, which has then been always received as a very bad sign.

SECT. CCCLXXXV.

THE disorder increasing, all these symptoms (382, 383, 384,) continue, but in a greater degree; and in the mean time the expressed lymph is carried off, and the red blood more inspissated.

All the symptoms which have been hitherto considered, arose from the hesitation of the impervious blood in the smallest extremities of the converging arteries, and from the impetus of the blood more forcibly impelled behind, and urging on the back of these obstructions: if therefore the tenacity of the obstructing matter is increased, or takes place in more of the small vessels, while the impulse of the blood urging behind is also augmented; it is very evident, that then all the symptoms must be increased. From hence a greater tumour of the inflamed parts, with a colour inclining towards purple, by reason of the extreme redness, a burning heat, intense pain from the distracted fibres being almost upon the point of break-

ing, with an extreme tenfity or fhining of the part, *etc.* And fince the blood cannot pafs through the obftructed veffels, into which it is propelled, the thinner parts will go off by the lateral veffels, the red part will remain alone impervious, and will be applied and compacted againft the obftructing matter by the force of the blood urging behind; from whence the quantity of obftructing matter will be continually increafing, and therefore its removal will become the more difficult.

S E C T. CCCLXXXVI.

IF the circulating humours are mild or not acrid, their motion fedate or not exceffive, and the obftructing caufe not too violent, the obftruction itfelf alfo but fmall, and feated either in the fanguiferous or in the beginning of the lymphatic arteries, then the obftructing matter concreated by ftagnation, being reduced to a ftate of fluidity by the motion of the veffels or diluting juices, the inflammation then terminates by a refolution or difperfon.

Every difeafe terminates either in health, another diforder, or in death; which is a general rule that takes place likewise in inflammations: and therefore we are next to confider the various ways in which they terminate. When the inflammation is fo difperfed, that nothing of the diforder remains, and all the parts are reftored to their functions which they formerly performed in health, without any other diforder following, it is then faid to be cured. But if the inflammation turns to a fuppuration, the firft diforder is indeed removed, but then another comes in its place; namely, an abfcefs follows. The fame is alfo true if the inflammation turns to a fcirrhus. But when a moft violent inflammation totally intercepts
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the vital influx and efflux of the humours to and from the affected parts; in that case the inflammation indeed ceases, but is followed with a gangrene first, and then with a sphacelus, which last is a true mortification or death of the part.

Of all the ways therefore of terminating an inflammation, the most desirable is that which physicians call a resolution or dispersion. That is, when the impervious matter, hesitating in the obstructed vessels, is by the remaining *vis vitæ* and the use of proper remedies so dissolved, or the vessels in which it is seated so disposed as to let that impervious matter pass into the veins, or else be repelled back into the larger vessels: so that thus a free circulation of the humours is restored through the vessels, before impervious, without injuring their continuity; and the concremented fluid being now dissolved, and mixed with the circulating humours, may pass freely through those narrow extremities of the vessels, which it ought to pervade agreeable to the laws of health. And when this takes place, the inflammation is said to be cured by a resolution.

It therefore remains for us to enquire into those signs which denote that this resolution is practicable; and all these we find enumerated in this aphorism. For the treatment is required to be very different, when it shall appear, that the inflammation will terminate in a different manner from that above mentioned, as will appear evidently from what follows.

If the circulating humours are mild.] All our healthy juices (except perhaps the bile, and those which are excrementitious) are so mild and inoffensive that they do not excite pain, even though they touch the eye or a naked nerve in a recent wound: and this was necessary, that they might pass with a pretty strong impulse in a healthy state through their very tender vessels, and yet not injure them. Since therefore the resolution of an inflammation supposes a motion of the stagnating humour, and a restitution

of its concremented parts to their former fluidity, without any destruction of the vessels; it is very evident that in this case they can have no considerable acrimony. for when the blood is forcibly impelled by the heart into the obstructed vessels, it is then pressed back again by the contraction of those vessels, while the heart is in its diastole; by which means the sides of the vessels will suffer a considerable attrition from the humours, so that if they contained acrimonious particles, it is evident that these tender small vessels would be dissolved and destroyed. This is the reason why, in scorbutical patients, the slightest inflammation arising in the legs, even from external causes, can hardly ever be cured by a resolution; but it almost constantly degenerates into an ulcer; and the same is also observed in all other ill habits of body, in which the juices are infected with an acrimony.

Their motion sedate.] It was demonstrated in the commentary on § 120, that when an obstruction is formed, the obstructed vessel is distended, dilated, and rendered thinner by the impulse of the fluids; so that it at length bursts asunder. But in that case the humours had no greater velocity than is usual in an healthy state; and it is very evident, that if the impulse of humours in the obstructed vessels is increased, the solution of their continuity will be more speedily effected. But in order to disperse or resolve an inflammation, it is required to preserve the continuity of the vessels; and therefore when an inflammation is accompanied with the most violent motion of the humours, there can be no hopes of a resolution.

The obstructing cause not too violent or confirmed.] An increased motion of the humours is not only prejudicial, inasmuch as it may break the continuity of the obstructed vessels, but also inasmuch as it compacts the obstructed particles together with a greater force. But to disperse an inflammation, it is required to resolve the obstructing concrete into those small particles,

particles, by whose combination the obstruction is formed: but the more the thinner humours are expressed, which prevent the mutual contacts of the grosser particles; so much the more strongly will these last be united and pressed together, the more firmly will they cohere, and the more difficult will it be to dissolve them again. But when the velocity of the circulation is increased, the thinner humours are dissipated, and the grosser compacted together, as we demonstrated in the commentary on § 100, and at the same time the compacting causes, which drive the impervious particles close to each other in the obstructed vessel, are oftener applied in a given time. Hence appears the reason why the most skilful physicians despair of a resolution in a pleurisy and such like diseases, in which a most violent fever has attended for above twelve hours time, and rather direct all their curative intentions to promote the concoction and excretion of the inflammatory matter.

The obstruction small, and seated either in the sanguiferous or in the beginning of the lymphatic arteries.] An obstruction is said to be small, either with regard to the part of the vessel which it occupies, or else because it takes place in but a few vessels of the part affected. Thus for example, if a red globule stagnates in the beginning of a dilated serous vessel, that obstruction may be more easily removed, than if the globule penetrated to the smallest extremity of the same serous artery. And also if the greater number of vessels in any part of the body are obstructed, each of these being dilated will compress and straiten those which are adjacent; whence the resolution of such an obstruction will always become the more difficult. But an inflammation may be dispersed most easily of all, when (*cæteris paribus*) the disorder is seated only in the larger vessels: for the efficacy of bleeding, and most of the other remedies for inflammations, is exerted chiefly in the larger vessels. Thus for example, if the red part of the blood stagnates in
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the smallest extremities of a sanguiferous artery, or has entered into the serous vessels by error of place, or else into the lymphatics which are of the next magnitude to the serous vessels, it is evident that the obstructing matter ought to be so attenuated or dissolved, or the obstructed vessels so relaxed as to afford a passage; or else, lastly, the obstructing matter must be repelled back from the smaller to the larger capacity of the vessel. But a red globule readily dissolves into the serous globules of which it is composed, according to the observations of Leeuwenhoek; and thus likewise may the serous globules dissolve into the smaller lymphatic ones; therefore such an obstruction, seated in the sanguiferous or in the beginning of the serous and lymphatic arteries, may be thus terminated or resolved. But if a red globule should have entered vessels much smaller than these, it would not be capable of passing through its smaller extremities, even though it was to be resolved into serous or lymphatic globules; from whence the difficulty of resolving the inflammation in this case is sufficiently evident. Another means of the greatest efficacy in the resolution of inflammations, is the diminution of the quantity and impulse of the humours urging on the back of the obstructions, made by a plentiful bleeding, that the obstructing matter may be repelled by the natural contraction of the vessels from their narrower to their larger capacities, (see § 141.) This repulsion depends upon the re-action of the vessel, when the cause of its distention ceases, and therefore it will take place the most effectually in the largest vessels, which have the strongest and most elastic membranes or coats; whereas little good can be from hence expected, when the obstruction is seated in the smallest and most tender vasculæ. From hence therefore the reason is evident, why it is necessary for the obstructing matter not to be seated in the smallest vessels, in order to cure the inflammation by a resolution or dispersion. This is confirmed by many

ny practical observations, and is most apparently demonstrated in an ophthalmia, in which disorder we may very plainly perceive the inflamed vessels of the eyes. For as long as the vessels of the tunica adnata only appear, and there is no apparent defect in the pellucid cornea, there are great hopes of obtaining a perfect resolution without any defect remaining: but when the very minute and pellucid vasculæ of the cornea are dilated so as to admit the grosser humours, the inflammation can never be so entirely dispersed, but either a suppuration or opaque spot will be left in the cornea, which will sometimes disfigure the eye as long as the patient lives.

The vessels moveable.] For the maintenance of health it is required that our vessels yield to the impulse of the fluids; and then again for them to return to their former diameter, when the distending cause ceases; and this is called the mobility of the vessels. Now there are two different and even opposite causes, which diminish, and may even sometimes totally destroy the due mobility of our vessels; namely, when their sides or coats are so much relaxed, that they very easily give way to the humours impelled by the heart, but have so small a degree of strength or elasticity, that when the heart ceases to act, their force is not sufficient to propel forwards their contained blood; and on the contrary, the sides of the vessels are sometimes so rigid, as scarcely to suffer them to be dilated by the impulse of the humours. The first of these defects is therefore a too great weakness, and the latter, a too great strength of the vessels. When the vessels are too weak, they may be so dilated, even by a small force, as to admit the grosser parts of the blood to mistake their course; but then, as they easily give way in this case, their ultimate extremities may be so dilated, as to readily transmit the grosser obstructing parts of the blood into the veins; whence it will be no great difficulty to remove the obstruction. To which add, that in this case

case the motion of the humours is always languid, and the fluids are never dense or compact for want of strength in their vessels; whence it readily appears, that inflammations seldom arise in such habits, and that there is no great difficulty in curing them when they do arise. But when there is too great a strength in the vessels, the blood is always compact or dense, and deprived of its more fluid parts, which will cause the more gross parts to unite, and render the inflammation difficult to remove when it is once formed; and this partly from the thickness and imperviousness of the humours, and partly from the greater strength or contractal power of the obstructed vessels, by which they resist dilatation, and more strongly confine the obstructing particles. This is daily observed in practice, where acute or inflammatory diseases in women or children are often easily cured by a mild resolution; but very seldom in adults, and those who have been inured to hard labour. The same has been also observed by Hippocrates^a, who says, *Corpora exercitata ac densa citius à pleuriticis et peripneumonicis morbis pereunt, quam non exercitata*; “Strong bodies used to exercise perish sooner by pleuritic and peripneumonic diseases than those who are not used to exercise.”

Diluting vehicle or juices.] When the most fluid parts of the blood are dissipated in the beginning of acute diseases, either by sweats, a diarrhœa, or any other evacuation, there is always great danger of a fatal event. For the grossest particles of the blood are not prevented from concreting or touching each other, but by the interposition of the more thin humours.

When blood is drawn from an healthy person, it appears an uniform fluid; but by standing it dissolves into two distinct parts: for the red globules unite and cohere, while the serum separates from thence. But if blood newly drawn be stirred about with a stick till

^a Coac. Prænot. 318. Charter. Tom. VIII. pag. 875.

it is cold, the separation of the serous from the red parts of that blood will be prevented, and the whole mass will remain a fluid; from whence it appears how necessary a thin diluent liquor is to prevent a concretion of the blood. For this reason Hippocrates condemns a wasting of the more fluid parts of the blood by sweats, a diarrhoea, *etc.* in the beginning of acute diseases: for he says^b, *Sudor multus, cum febribus acutis abortus, malus. In febre ardente, si alvus affatim proruperit, lethale*; “That a profuse sweat arising with acute fevers is bad;”^c and “that a profuse diarrhoea is fatal in an ardent fever.” It is also remarked by Sydenham^d, (who so diligently attended the endeavours of nature in the cure of diseases,) that if the patient is infested with profuse sweats in the beginning of the small-pox, all the symptoms are constantly augmented or rendered more violent.

If all or most of the circumstances before enumerated, attend an inflammation, there is reason to hope it may be dispersed without incurring any defect or morbid alteration; but this is not by discharging the morbid matter, nor by destroying the vessels; but by opening the obstructed vessels, and rendering the impervious matter more fluid. But if some of the conditions before mentioned, as necessary to a resolution, be absent; we are then to endeavour to supply their deficiency by art. The humours are to be rendered mild by a softening diet and medicines; the too great velocity of the circulation is to be quieted by bleeding, rest, a cool air, *etc.* the vessels of the affected part are to be relaxed by applying fomentations, that they may give way more easily to the obstructing matter; a diluting vehicle is also to be supplied by a thin and watery drink, avoiding every thing at the same time which tends to drain off the most fluid

^b Prorrhēt. Lib. I. n^o. 57. Charter. Tom. VIII. pag. 740.

^c Coac. Prænot. n^o. 130.

^d Sydenham, Opusc. Universa, pag. 321.

350 Of INFLAMMATION. Sect. 386, 387:
part of the humours from the body. But of all these
we shall speak more largely in the cure of an inflam-
mation following.

S E C T. CCCLXXXVII.

IF the circulating humour is mild, its motion rapid, the obstruction great and incapable of resolution (386); then the symptoms increasing (382, 384, 385), the distended vessels break with pain, heat, pulsation, and tumour; they extravasate their contained humours, which are then dissolved and gently putrefied, and do themselves break off and dissolve the adjacent solids, which mix with the fluids, and form a similar, white, thick, glutinous, and unctuous humour called pus or matter; and this, which is termed *suppuration*, is the second way in which an inflammation is often terminated.

When the obstructing particles are so firmly compacted in the extremities of the converging vessels, that there is no passage afforded for the diluting vehicle to dissolve and carry them into the veins; the increased motion of the fluids, acting behind, still continues to force the obstructing particles further into the more narrow parts of the vessels; from whence it is evident, that at length the impervious matter will be most violently compressed, and stagnates without the least motion in the obstructed vessel, from the narrowest part of which it cannot be repelled towards the broader basis. Therefore the whole length of this inflamed vessel will be quite destitute of the vital influx of the humours, and therefore it will be necessary for it to separate from the other living and sound parts. Now we are assured from a diligent attention to nature in the cure of diseases, that a sup-
puration

puration separates every part, which was destroyed by the inflammation, from those which are living and sound: from whence it is evident, that a suppuration is not so much to be feared, except in those parts of the body, whose continuity is absolutely necessary for the maintenance of life and health; as for instance in the encephalon, or in a part where the matter cannot be safely extracted, as in a pleurisy, *etc.* But in what manner all those parts, which have been rendered unfit for receiving the vital motion of the fluids, are separated by suppuration, may very well appear from what has been said of this subject in the history of wounds; where we enumerated all those appearances which are observed in an healthy body in every wound, from its first infliction to the completion of its cure, (see the commentary on § 158.) For in the first place the blood is extravasated from the wounded vessels, whose orifices contracting, then discharge only a thin and reddish ichor; the surface of the wound now appears almost dry, and a true inflammation arises from the vital motion of the humours urging against the obstructed ends of the vessels; as is evident from the pain, heat, redness, tumour, slight fever, thirst, *etc.* In the next place the extremities of the impervious vessels separate, together with part of the impervious fluid impacted in the extremities of those vessels; whence arises a viscid, white, and unctuous fluid, called pus or matter, upon the surface of the wound; and after a careful absterision of this matter, the whole surface of the wound appears evenly moist, which is an evident sign that the vessels, which were before obstructed, are now opened by a separation of their impervious and contracted extremities. A suppuration is therefore that salutary endeavour of nature, by which she separates from the other sound and living parts every thing which is become unfit for receiving the vital circulation. Hence Hippocrates well observes, (see the passage cited § 158. numb. 7. and § 323.) that a wound inflicted by a sharp instru-

ment may be cured without suppuration; but that contused and dissected flesh must putrefy or waste away by turning into matter. But although he here uses the word putrefy, when he treats of a suppuration; we are not therefore to understand such a putrefaction as happens in a dead body, but a different kind of degeneration in the humours made by the life remaining. This has been very well distinguished by Galen^a, where he treats of fevers; for he recommends urine that has a white sediment, which is light and uniform, as a very good sign, denoting that the matter of the disease is attenuated and evacuated from the body. But he calls this change in the urine a corruption, where he says, *Putredo autem humorum, quæ fit in vasis, similis est illi, quæ fit in inflammationibus et abscessibus et aliis tuberculis, etc.* “ But the putrid state, which the humours acquire “ in the vessels, is like that which happens in inflammations, abscesses, and other tumours, etc. He likewise tells us there are two kinds of this corruption; *Alterum nempe fieri, vincente natura; alterum vero, devicta. Vincente quidem natura, uti in inflammationibus et tuberculosis omnibus tumoribus pus fit; in humoribus autem arteriarum et venarum illud, quod subsidet in urina puri analogum. Hæc autem putredo non simpliciter putredo est, sed aliquid coctionis habet. Manente enim concoquendi facultate vasorum, putrescens tunc humor ad talem alterationem deducitur;* “ Namely, “ one of them which happens when nature over- “ comes the disease; and the other when the disease overcomes nature. When nature overcomes “ the disease, there is a formation of matter like that “ which is made in inflammations, and as happens in “ all tumours; but that which subsides in the urine “ resembles matter, when in the humours of the arteries and veins. But this kind of corruption is “ not simply a putrefaction, but a kind of concoc-

^a De Febribus, Lib. I. cap. 7. Charter. Tom. VII. pag. 115. et ibid. cap. 8. pag. 116.

“ tion or digestion ; for while the digestive or attenuating power of the vessels remains, the corrupting humour is reduced to the state abovementioned.” From hence it evidently appears, that the formation of matter is very different from a spontaneous putrefaction of the humours.

But the change of an inflammation to suppuration, when it is not resolvable, seems to be performed in the following manner. The humours urge up on the back of the obstructions, and enter the obstructed vessels at every contraction of the heart, with a velocity increased by the attending fever ; from hence the sides of the obstructed vessels will be gradually distended, and separated from their cohesion with the extreme parts which remain obstructed : but while this is performing, the humours are extravasated from their ruptured vessels, and being attenuated by the warmth of the parts, they enter into an incipient putrefaction and dissolve both the impervious fluids, which hesitated in the extremities of the separated vessels, together with the tender solid parts, which before contained the obstructing matter ; all which being worked up together, attenuated and intimately mixed with the extravasated juices, they receive such a change by warmth and stagnation, that the whole forms a similar or uniform fluid, called pus or matter. It may perhaps seem surprizing, that the solid membranes of the vessels should be thus dissolved, and mixed with the juices, in such a manner as to form a fluid which is uniform in appearance ; but the difficulty will be removed, if we consider the incredible tenuity of these small vessels. For it appears from the estimates made from the observations of Leeuwenhoeck and other learned men, that almost fifty millions of red blood globules, do but equal the weight of a single grain ^b. But the smallest sanguiferous arteries transmit only one such globule at a time ; from whence it is evident how small and tender these vas-

^b Medical Essays, Tom. ii. pag. 113.

cules must be: But these smallest sanguiferous arteries are still the largest among the smaller or decreasing series of those vessels. But we proved before, that a true sanguine inflammation might be also seated in the serous and in the lymphatic arteries: Will it therefore any longer seem surprizing that the solid stamina, or threads of those small vessels should be thus dissolved and mixed with the fluids so as to disappear? We sometimes observe in consumptive people, that the whole substance of the lungs has been spit up in the form of matter, insomuch, that upon opening the body after death, the physicians have with good reason wondered how life could be continued so long with so small a part only of this important viscus remaining.

That fluid which is formed of the extravasated humours, and tender solids combined together, and mixed by attrition, is called pus or matter; which when laudable, or formed by a perfect maturation after an irresolvable inflammation, has the following conditions: namely, it appears white, and almost of the thickness of cream, unctuous to the touch, and uniform in every particle, without any manner of foreign substance. But when matter has not these conditions, it is said to be bad. All this has been remarked by Hippocrates ^c, in his prognostics, where he says: *Pus autem optimum est album, & æquale, & leve, & minime fetidum: quod autem maxime huic contrarium est, pessimum est;* “ But the best matter is “ white, uniform, smooth, and the least foetid; but “ matter which is the most contrary to this, is of the “ worst kind.” And thus Celsus ^d, in treating of what is discharged from the wounds and ulcers; namely concerning blood, foul matter, and ichor, &c. says: *Pus inter hæc optimum est. Sed id quoque pejus est, multum tenue, dilutum; magisque, si ab initio tale est: itemque si colore sero simile, si pallidum, si lividum,*

^c Sentent. 42. Charter. Tom. VIII pag. 617.

^d Lib. V.

cap. 26. n. 20. pag. 289.

fi fœculentum. Præter hæc fi male olet; nisi tamen locus hunc odorem excitat. Melius est, quo minus est, quo crassius, quo albidius: itemque fi læve est, fi nihil olet, fi æquale est; “ Among these, pus or matter is “ the best. But of this the worst kind is that “ which is very thin and dilute; especially if it “ was so from the beginning: and it is also bad, “ when the colour of it is like serum, pale, li- “ vid or fœculent. To which add an ill smell, ex- “ cept it is derived from the part. The matter is “ the better, as it is less in quantity, thicker and “ whiter; appearing also smooth and uniform, with- “ out any smell.” A little afterwards he well ob- serves, that the matter being formed, terminates the inflammation: for he says, *Modo tamen convenire & magnitudini vulneris & tempori debet. Nam plus ex majore, plus nondum solutis inflammationibus naturaliter fertur,* “ That the matter ought also to be agreeable “ to the magnitude and the age of the wound; for “ more matter is naturally discharged from a larger “ wound, and more before the inflammation is gone “ off.” Now when the inflammatory matter is too stubborn or compact to be digested into pus; or when the concocting powers are weaker than is necessary for that purpose, or when both of these concur together; then there is not a matter formed as above conditioned, but the fluid produced deviates more or less from those conditions, as Galen^e well observes, in his explanation of the text of Hippocrates last cited. For after having said, that the blood is transfused in a phlegmon into the void spaces near the vessels (that is into the cellular membrane,) he says it cannot then return to its former state, but will change and putrify in the same manner as all other juices do, which are violently heated in some foreign part; and he then adds: *Itaque si innatus calor a propria temperie plurimum recesserit, sanguis, ut in cadavere, putrescit. Si autem ille adhuc aliquam vim retinet, mixta quedam*

^e Comment. 1. in prognost. Hip. Charter. Tom. VIII. pag. 618.

sanguinis mutatio fit; partim quidem ab ea, quæ præter naturam, partim vero ab illa, quæ secundum naturam causa est; quarum ut illa, quæ præter naturam est, putrefacit; sic illa, quæ secundum naturam est, causa concoquit. Earum vero utraque prævaluerit, protinus indicia, tum in colore, tum in odore, tum in consistencia, necessaria consequuntur; “ So that if the innate heat
 “ is too low, or deviates much from its proper temperature, the blood then putrefies as in a dead
 “ body. But if it as yet retains some force, the blood then undergoes a kind of mixed alteration,
 “ partly from the deficiency of nature, and partly from that power which she yet retains; and therefore there follows a putrefaction of that which is
 “ preternatural, and a concoction of that which is agreeable to nature. But which of these conditions prevails most, may be known from the necessary consequences or signs which immediately appear both in the warmth, in the smell, and in the
 “ consistence of the matter.”

The formation of matter therefore depends on, or results from the remaining health; whence it is justly reckoned, by Hippocrates ^f among the worst signs of diseases, for an ulcer to become dry, and discharge no more matter either before or in a disease; for he pronounces that such a patient cannot long survive.

But that the inflamed part tends to suppuration, is known from the following circumstances.

If the circulating humour is mild.] For if there is any considerable acrimony in the humours, it will be still much more increased by the stagnation and greater heat of the inflamed part; from whence would follow an erosion and destruction of the vessels, instead of that mild suppuration of their obstructed ends only, which happens in a suppuration.

^f Hippoc. prognost. Sentent. 22. Charter. Tom. VIII. pag. 605. & Coac. prænot. n. 496.

Its motion swift.] In the resolution of an inflammation, a sedate motion of the humours is equally necessary with their mildness; but when a suppuration follows, there is always a greater velocity of the circulation: Whence a suppuration seems to be a sort of medium betwixt a resolution and a gangrene. In a resolution, the concremented or stagnating humours are removed and reduced to their former state of fluidity; without offering any further injury to the vessels, or making any evacuation of the impervious juices: but in a gangrene, there is a true death of the inflamed part, which must therefore be separated afterwards from the adjacent living vessels. Now, in a suppuration, the ends only of the obstructed vessels are separated or thrust off, and mixing with the extravasated humours, are formed into matter, under which appearance they are to be discharged; and in this a suppuration differs from a resolution; but from a gangrene it differs, in as much as a suppuration does not destroy all the parts affected. Hence, therefore, the particular velocity of the humours through the part, as well as that of the whole mass in general, which accompanies an inflammation, ought to be very sedate, to afford any hopes of obtaining a resolution: and, on the contrary, it is evident, that if a violent fever attends, a gangrene must soon follow; but if the motion is not so sedate as in a resolution, nor yet so swift as is usual in a gangrene, the inflammation must then terminate in an abscess or suppuration. When there are no hopes of obtaining a resolution, it may be as pernicious to lessen the fever too much, as to imprudently render it more violent; as will appear more evidently hereafter, in the commentary on § 403. numb. 3.

The obstruction large, &c.] In what respect an obstruction is to be termed large or small, as also what signs there are denoting its resolution, has been already declared under the preceding aphorism. But an inflammation is principally known to tend to a

suppuration by the increasing of the tumour, heat, pain, redness, and other symptoms enumerated in the aphorisms here cited; but these ought not to increase very suddenly, for then they rather threaten a gangrene, but they should rather make a constant and gradual increase. It would perhaps be a difficult matter to know exactly the bounds, where the possibility of a resolution terminates, and where an incipient suppuration begins; but this is certain, that the pain, pulsation, fever, heat, &c. do manifestly increase at the time when the inflamed part suppurates. But when the suppuration is finished, all those symptoms are again diminished, as Hippocrates^s very well observes, where he says: *Circa puris generationes dolores & febres magis accidunt, quam pure facto*; “That the
 “ pain and fever are more intense about the time of
 “ the formation of matter, that when the matter is
 “ quite formed.” Nor is this at all surprizing, since the distended vessels must excite the most acute pain at the time when they are nearest to a rupture; but when they are once broke, the pain thence arising immediately ceases. See § 221.

S E C T. CCCLXXXVIII.

IF the humour is acrimonious, violently moved, the obstruction large, and the vessels rigid, then all the symptoms (382, 386, 387) are violent; and the small vessels suddenly bursting open, their juices become putrified; hence an ichor is extravasated and collected like the washings of flesh in blisters under the cuticle, or else there appears a yellow, pale, ash-coloured, brown, or black coloured foul matter: in the mean time, the redness, pain, heat, pulsation, and tumour leave the affected parts, and invade those which are adja-

* Aphor. 47. Sect. 2. Charter. Tom. IX. pag. 85.

cent, whereupon follows a death of the part affected, which is termed a *gangrene*; being the third manner in which an inflammation sometimes terminates.

We come now to the third manner in which an inflammation terminates, which is called a *gangrene*. When the vital circulation of the humours through the arteries and veins is from any cause destroyed in some soft part of the body, it occasions a death of that part; which while beginning and performing, is termed a *gangrene*. Therefore this manner of terminating an inflammation differs from a suppuration, in as much as all the motion of the humours is intirely destroyed in the affected part, by a sudden rupture of its small vessels; whereas in a suppuration, only the extremities of those vessels are gradually separated, by the motion of the vital humours urging behind. But an inflammation more especially tends to a *gangrene*, when attended with the following circumstances.

If the humour is acrimonious.] Any very sharp substance or liquor applied externally to the body, causes a *gangrene*, whether it be acid, alkaline, or of any other species of acrimony. For thus true gangrenous eschars are formed, by touching the skin either with oil of vitriol, the potential cautery of the surgeons (formed of a sharp alkaline salt, boiled up with quick lime) the acrid empyreumatic oils of hartshorn, of lignum guaicum, the volatile alkaline salts, &c. and the same thing also happens when the mass of blood itself is infected with acrimonious particles. It is indeed true, that these acrimonious particles cannot easily enter into the blood; and yet we observe in disceates, that the humours often degenerate surprizingly into an acrid state, by which the soft parts are often suddenly corroded and destroyed. In the worst species of the scurvy the gums are often de-

stroyed by a true gangrene or putrefaction, with an intolerable smell; and the most malignant ulcers, suddenly tending to a gangrene, arise in various parts of the body and especially in the legs. And the like disasters are also observed to follow from a turgescence of the vessels with atra-bilis joined with a violent motion, as we shall explain more at large in § 1104. From whence it is evident, that if a considerable acrimony of the blood is also accompanied with an inflammatory spissitude or tenacity, that then the vessels must be suddenly destroyed, and a gangrene produced.

Violently moved.] We have already seen, that a sedate motion of the humours favours the resolution of an inflammation, and that a motion more strong or swift also promotes a suppuration; but a motion still more violent will act so forcible upon the obstructed ends of the small arteries, as to break them all open suddenly, and not produce a gradual separation of them, as is done in a suppuration. But a swift motion of the circulating humours throughout the whole body, is known by the quickness of the pulse, and frequency of the respiration; while the most intense pain and heat also denote the same thing in the inflamed part. If then an acrimony of the humours be added to their increased motion, it is very evident, that these very fine vessels must be very speedily destroyed; since the humours are in this case applied not only with an acrid or dissolving power, but also with a greater impetus, and oftner in a given time. It was also demonstrated in the commentary on § 100. that a bare increase of the circulation, renders the salts and oils of the blood more acrimonious; and from hence again will arise a new stimulus, increasing the velocity of the circulation, so as to be still more productive of itself. From all which it is sufficiently apparent, what danger an inflamed part is in, when there is a violent fever attends,

The vessels rigid.] It was demonstrated in the commentaries on § 52. that an increased rigidity or too great a strength of the vessels rendered the blood very thick or compact, and dissipated its more fluid parts, by which means it became more inclined to concretion. And we lately observed (§ 386.) that a mobility of the flexible vessels, and a diluting vehicle, are two of the chief means from whence we are to expect that inflammation may be resolved: and therefore if the contrary of these take place, they will be always followed with more fatal consequences. As in this case the humours move through the vessels with a great velocity, their whole impetus will act upon the ends of the obstructed vessels, a great part of which impetus would have been otherwise spent in dilating the sides of the flexible vessels; and from hence the ends of the vessels will be suddenly forced or broke off by this greater impulse or more sudden action of the humours upon the obstructed matter; whence will be occasioned all the consequences hereafter enumerated. And from hence the reason is also evident, why inflammatory diseases are generally so fatal in people who have been addicted to hard labour.

Then all the symptoms are violent.] If the tumour of the inflamed part suddenly increases, the redness becomes intense or inclines to a purple, the heat burning, and the pain severe or continually increasing, accompanied with a quick pulse and a difficult respiration, &c. a gangrene will then follow in a little time.

The vessels are suddenly broke, &c.] If now we consider that an acrid humour is here violently impelled against the ends of the vessels, so obstructed with impervious matter, that they are quite incapable of transmitting any part; it will readily appear, that we ought to expect a sudden rupture or dissolution of those vessels, and this especially if the too great rigidity of the vessels renders them less apt to be distend-

ed without breaking. The vessels once broke, they extravasate their juices, which spontaneously corrupt, and that in a little time, since the intense heat, which always accompanies a violent inflammation, very much promotes putrefaction, as was said before at § 84. numb. 5. But while all this is performing in the inflamed part, there are certain sensible alterations to be observed, which teach us, that a gangrene is already present, or will very suddenly follow. But all these appearances are perfectly like those which arise from the application of fire to any part of the body, as we observed in the commentary on § 370. For then the cuticle begins to separate from the subjacent skin, and becomes elevated into blisters by the extravasated humours, which blisters are generally filled with a reddish coloured ichor, or in a worse stage of the disorder with a thin yellow matter: hereupon the shining redness of the part changes into an ash, pale, brown, or even at length into a black colour; and the disorder is known to have made a greater or less progress, in proportion as the colour inclines from that of a pale ash to blackness. Hereupon all the symptoms of inflammation diminish, and sometimes they seem entirely to disappear; nor need we wonder at this, since the inflammation arises from an increased velocity of the humours from the *vis vitæ* which remains. Hence the redness disappears, and the blood is no longer impelled through the vessels of the part affected; and since for the same reason the nervous fibres of the vessels are no longer distended, the pain also ceases. Since the heat and pulsation supposes a violent attrition betwixt the impelled fluid and the sides of the vessels, therefore they also disappear when a gangrene follows upon an inflammation; and hence a sudden cessation or remission of the pain and other symptoms in acute inflammatory diseases is justly esteemed fatal, if the proper signs have not first preceded. For when a gangrene arises after a violent inflammation in some external part of the body, it is easily

easily apparent from the forementioned signs, whether the disorder is present; but when the internal parts of the body suffer the like disorder, a sudden cessation of the pain affords the principal sign of the gangrene. Thus in the most violent pleurisy, and most painful inflammation of the intestines, the acute pain often suddenly goes off, and the patient perishes soon after he imagined the disorder to be overcome. These are the fallacious changes in the worst diseases, which often prove prejudicial to the character of a physician; for being thus deceived, he imprudently presages a happy event of the disease, which yet proves fatal in a little time.

The vessels being therefore destroyed, all the vital influx and efflux of the humours into the affected part will be abolished, that is, a death of the part follows, and then all the consequences of a spontaneous corruption of the mortified part soon follow. If we look into those changes which are made in the flesh of animals lately killed, and exposed to a warm air, they will appear to be almost the same with what we observe in gangrenous parts. For the lively red colour of the flesh begins first to disappear; a pale ash colour, gradually inclining to brown, succeeds; and at length the putrefying flesh turns almost black, and forms a stinking matter, which was but a little before solid flesh: but all these symptoms happen sooner in the gangrenous part, as the warmth of the adjacent living parts increases the putrefaction of those which are mortified.

But the adjacent parts which are not dead, having their humours as yet pervious, those humours will be obstructed in the borders of those parts which interpose between the dead and the living, being incapable to pass through the part which is already dead: and from hence a new inflammation arises as it were round the gangrene, after which a suppuration following, the dead or gangrenous parts are separated from the living, or else the gangrene spreads into the contiguous

tiguous parts by the destruction of the vital motion of their humours. But what has deceived some unwary physicians, is their believing the part to be not yet gangrenous, because there is a pain still perceived in it; though properly speaking there is not any sensation in the gangrenous part, but a pain arises only in those subjacent or ambient parts which are yet living and inflamed. But it is always esteemed a good sign if the whole compass of the gangrenous part appears red, painful, hot, tense, &c. provided the symptoms are not so violent as to turn the inflammation into a gangrene: for we then know, that the life remaining in the rest of the body, endeavours to separate the gangrenous or corrupted from the adjacent living parts.

S E C T. CCCLXXXIX.

WHEN a part thus affected (388.) is compressed externally, or the intense heat dissipates much of the moisture, then the dead part is indurated and dried up like leather, otherwise the subjacent parts, being destitute of the circulation, corrupt.

Now in the part where the gangrene is seated, there is no motion of the humours through the vessels, but a mere rest or stagnation of them, from whence the same changes follow there, as happen from the same causes in a dead body. The heat of the living subjacent parts, being also accompanied with a moisture, converts all that is mortified into a putrid matter; but if their moisture is exhaled either by intense heat or external compression, then the part mortified is dried up and hardened perfectly like a black and dry skin or leather, being frequently so tough as to be scarcely divisible by a razor. But this is chiefly observed in the external parts which are covered with
the

the skin; for in other parts the gangrene rather dissolves them into a putrid matter. Thus I saw the intestines were converted into a putrid matter within the space of two days time, in a man who died of an incarcerated rupture, though the man was before in health, and the disease continued for no longer a time. But when a gangrene arises in acute diseases about the os sacrum and coccyx, from the patient's lying too long on his back, there appears then very black and dry spots in the affected skin. But how suddenly a gangrene may arise, and the skin grow black and hard like leather even in an healthy person, barely by an external compression, may be learned from the following accident. While two carpenters were preparing the vast body of a tree, in order to make it into the axis of a mill, in turning it round, it unfortunately happened to give way while it was elevated by the hand-spikes, and by its weight it threw both the men into the adjacent pit, where one of them was instantly pressed to death by the weight of it, and the other was obliged to sustain the weight of it, for above half an hour lying upon the spine of the tibia of his left leg. By good luck the bottom of the pit was covered with a good deal of soft mud, which prevented the pressure from doing so much injury as it otherwise might; so that the man returned home joyfully without being much damaged, being able to stand and walk upon his legs for above a quarter of an hour without detriment: but I being called on the next day found many large and small black spots in the anterior part of the leg, where the os tibiæ has its surface covered almost with nothing but the integuments, and these spots resembled a withering or deadness arising from contusion; but after a more strict examination the skin of those parts appeared very black and hard like leather. For the rough surface of the beam had so compressed the skin by its weight against the subjacent bone, that it became quite destitute of all the vital influx and efflux
of

of its humours; and afterwards all those dead parts were separated by a suppuration formed all round their margins. Here I had a fair opportunity of seeing what a bare compression was capable of effecting, and of seeing the reason why those parts of the skin so soon mortify sometimes in diseases, upon which almost the whole weight of the body is supported when a person lies long in bed. But when this hard part of the skin like leather is pressed against the subjacent living parts, they are inflamed, so much tumified, and likewise compressed, (if the horny matter cannot be separated from the living parts to which it adheres,) that the disorder by that means spreads itself deeper.

S E C T. CCCXC.

THIS change of an inflammation into a gangrene (388) is speedily promoted by the use of every thing which is actually or potentially cold, which astringe, coagulate, or repel; also such as are fat and acrimonious, emplastick or narcotic, strong ligatures or an external compression.

This aphorism enumerates those things, which, being applied to the inflamed parts, are found to cause a sudden change of an inflammation into a gangrene.

Things actually or potentially cold.] Among those causes, which disposed an inflammation to turn to a gangrene, we enumerated a large obstruction and a rigidity of the vessels, see § 388. but the effects of cold are a greater contraction and strength of the solids, and to increase the imperviousness of the fluids. The most intense cold will therefore quite intercept the circulation of the humours by congealing them and by contracting the vessels; whence a sudden mortification of a part often follows from a severe frost: but when the *vis vitæ* is capable of removing the ob-

structions in the frigid part, then an intense heat arises from an attrition of the more condensed humours through their contracted vessels; which last is a thing frequently experienced by those who have been rubbing their hands with snow, when the uneasy sense of cold is soon followed with an intense heat. From hence it is evident, that the application of cold things to an inflamed part must be prejudicial, inasmuch as they either totally intercept the circulation, or inasmuch as they excite a more intense heat afterwards in the parts which are already too hot. But sometimes the application of cold things may be serviceable, when the grosser parts of the humours have entered the smaller vessels by an error of place, as the vessels, being contracted by the cold, may repel the matter back into the larger branches; and this more especially when the disorder is seated in the thinner humours, since the red part of the blood immediately congeals in cold water, but the serum and thinner lymph does not. But it is easily apparent, that no good can be expected from the application of cold things, when the disorder is recent and at the same time mild; for if the obstructing matter of the inflammation is so impacted in the smallest extremities of the vessels as to be quite stagnant, the disorder will be then rather increased. But all this is exactly agreeable with the doctrine of the antients. Thus Hippocrates ^a, after having in two places observed, that cold, among other evils, produces gangrenes or blacknesses, (μελασμός) he soon afterwards adds, that it may be sometimes serviceable, and enumerates the uses of cold things: ^b *si inflammationes & ardores in rubrum & subcruentum vergant ex recenti sanguine. Inveteratas enim (inflammationes) denigrat. Et erysipelas non ulceratum juvat, ulceratum vero ledit;* “ That
 “ they may be serviceable when inflammations and
 “ heats incline to a red or blood colour from recent

^a Aphor. 17. & 20. Sect. V. Charter. Tom. IX. pag. 204, 205.

^b Ibid. Aphor. 23. pag. 208.

“ blood. But cold turns inveterate inflammations to
 “ a gangrene or blackness. It is also serviceable in an
 “ erysipelas which is not ulcerated; but it injures one
 “ which is ulcerated.” And though Galen^c recom-
 mends the use of coolers in a phlegmon, he yet adds
 some good cautions, when he says, *Magisque profecto*
ad incipientes phlegmonas frigidis & adstringentibus,
quam discutientibus, est utendum: atque etiam magis, ubi
crassum non est, quod confluit. Vehementi enim in parte
inflammata incuneatione (σφηνώσεως) facta, non est amplius
repercutientibus utendum, sed tunc tempestivum est discu-
tere; “ And in truth coolers and astringents are ra-
 “ ther to be used to incipient phlegmons than discu-
 “ tients; and this more especially when the obstruct-
 “ ed matter is not gross or thick: for when the ob-
 “ structing matter is wedged into the vessels of a
 “ part violently inflamed, there is no more opportu-
 “ nity to use repellents, but then it is time to pro-
 “ cure a discussion.” They certainly could not have
 said better if they had understood the nature of an in-
 flammation from the present known laws of the circu-
 lation. And in another place, in treating on the
 cure of an erysipelas, Galen observes^d, that this dis-
 order requires more cooling than a phlegmon; and
 then he adds, *Esto autem refrigerationis terminus coloris*
mutatio. Etenim exquisitum erysipelas statim cum hac
quiescit: non exquisitum vero, sed quodammodo phlegmo-
nodes, si plusculum refrigeris, lividam cutim facit. Si
ne sic quidem quis desistat, nigrescit, & potissimum in se-
nilibus corporibus: sic ut quedam ita refrigerationum ne
quidem discutientibus medicamentis perfecte sanentur, sed
relinquant scirrhusum quemdam tumorem in parte, &c.
 “ But let the use of coolers be determined by the
 “ change of colour in the part: for by this means a
 “ true erysipelas soon goes off; but it is not so if you
 “ cool a little too much, so as to make the skin li-
 “ vid in an erysipelas which is not a true one, but in

^cGalen. Meth. Med. Lib. XIII. cap. 6. Charter. Tom. X. pag. 301.

^dIbid. Lib. XIV. cap. 3. Ibid. pag. 320.

“ some measure phlegmonode. For if a person does
 “ not then desist, the part turns black, and this espe-
 “ cially in old people: insomuch that the parts, which
 “ have been thus refrigerated, cannot be then perfect-
 “ ly cured, even by the use of discutient medicines,
 “ without leaving a kind of scirrhus tumour be-
 “ hind,” &c. From whence it is sufficiently evident
 how precarious and uncertain it is to use coolers for
 the cure of inflammations, since they are by that
 means so easily converted into worse diseases, if they
 are not used in the very beginning of the disease, or
 in those cases where the inflammation arises from an
 error of place, not of the red blood, but of the thin-
 ner humors; as for instance in the erysipelas, the
 œdema callidum, and the like.

Things called actually cold are those which remove
 or diminish the heat of an healthy body to which they
 are applied, even though the things themselves were
 actually warm, or at least not much colder than the
 part itself of the body to which they are applied.
 They are therefore such things as either diminish or
 totally remove the causes of heat in the part. But
 heat arises from the motion of the fluids through the
 vessels; which motion being diminished, the heat de-
 creases, and the reverse: whence it is evident that
 those things are said to be potentially cold, which ei-
 ther remove or diminish the strength and velocity of
 the circulation. Thus warm water applied to an in-
 flamed part may remove or diminish the too intense
 heat, by relaxing the vessels, and diluting the ob-
 structing particles: from whence it may be said to be
 potentially cooling, notwithstanding it is actually
 warm. But it is very evident, that these and the
 like potentially cooling remedies are seldom prejudi-
 cial to inflammations; as will be still more evident,
 when we come to the cure of an inflammation. For
 these last do not destroy the motion of the humours
 through the vessels, but they restore the equality of
 the circulation by removing the obstructions; whereas

potentially

those, which cool by intercepting the vital circulation; are highly pernicious, which we are told are the consequence of some poisons. Thus when Socrates had drank the juice of the cicuta, he felt his legs grow cold, and that coldness ascending above the pubes, he presently expired.

Which astringe or coagulate.] For by these the capacity of the vessels is diminished, and their humours are rendered impervious; both which consequences tend to increase the causes of the obstruction; they therefore destroy the free motion of the fluids through their vessels, which when totally abolished, forms a present gangrene in the part.

Repel.] The inflamed part tumifies, and that often to a great degree, for the reasons before mentioned at § 382. numb. 1, 2. from whence the antient physicians concluded, that a matter was here accumulated, which was not there before, and which must therefore have been derived from other parts. Now as they observed that this accumulation was often made very suddenly, they judged it arose from an afflux of humours; and therefore placed the cure of the disorder in repelling them, especially towards the beginning of the disease, as was a little before proved under the same aphorism in the passage quoted from Galen. That such a repulsion of the blood from the ends of the arteries towards their bases is practicable, is evident from the most certain observations. The most healthy person, who is suddenly struck with fear, has instantly a paleness of his face and lips, which denotes that the red blood is repelled towards the heart and larger vessels; and therefore a palpitation of the heart with anxiety soon follow this paleness. The same also manifestly happens when a person faints away. But the particles of the blood, which are repelled in these cases, may be also repelled from the smaller into the larger vessels by the same action when they have mistaken their course, and thus may the obstruction be resolved. But how far this may be serviceable,

serviceable, was declared a little before, when we treated of the application of coolers to inflamed parts: but as all those things, which are externally applied to cause this repulsion, act by contracting the vessels, it is very evident that their use must be dangerous, except in the beginning of an inflammation arising from an error of place; and that therefore if they do not immediately prove serviceable, the disorder will by that means be increased.

Such as are fat and acrimonious, or emplastic.] Concerning these see what has been said in the commentaries on § 376. For since these are of themselves sufficient to produce an inflammation, they will doubtless increase an inflammation arising from other causes, especially if they adhere to the affected part by an emplastic tenacity; for then they render the part affected less perspirable, and the mixt acrimony will remain a long time fixed to the part.

Narcotic.] These perhaps are in their own nature not so much to be condemned, especially if they are prudently applied. But as all these only obtund the sense of pain, leaving its cause remaining; therefore the inflammation often increases every minute, and a gangrene follows by a destruction of the vessels, without giving us any intelligence by the sense of pain. But an acute pain, heat, pulsation, and the other symptoms sufficiently advertise both the patient and the physician of the ill consequences which are to be feared or expected, unless they are deceived by removing the sense of pain by the use of narcotics; whence in such a case the most efficacious remedies are neglected, which might have prevented this termination of the inflammation in a gangrene.

Strong ligatures.] In what manner a gangrene may arise from hence, has been declared in the commentaries on § 355. But it is very evident, that if a part already inflamed is compressed by a strong ligature, the same disaster is to be expected much sooner.

An external compreffure.] Of this we treated under the preceding aphorifm.

S E C T. CCCXCI.

AND all thefe caufes likewise haften a gangrene into a fphacelus.

It was demonftrated in the commentaries on § 374. that a true phlegmon is moft frequently feated in the cellular membrane, which it fometimes diftends to an immense bulk: infomuch that the thin cellular membrane upon the back of the hand is fometimes fwelled to the thicknefs of two or three inches above the reft of the fkin. When therefore a gangrene follows an inflammation feated in this part, the whole corrupted mafs muft be afterwards feparated. And it is no uncommon thing for one to be able to enter the fcalpel to a confiderable depth without any fenfe of it, which might occafion one to believe that all the fubjacent parts are dead. But it very frequently happens, that the fubjacent tendons and mufcles are living neverthelefs: and then the gangrene is not yet become a fphacelus: for in this laft diforder all the incumbent parts are mortified even to the bone, as we fhall declare hereafter in the commentary on § 429. But when the panniculus adipofus is fo much diftended, already invaded with a gangrene, and in the mean time confined by the tough fkin, it will comprefs all the fubjacent parts, and therefore the vital circulation may be hence intercepted even in thefe; and then the gangrene paffes into a fphacelus or perfect mortification of the part. Every thing therefore which has been enumerated in the preceding aphorifm, as capable of turning an inflammation into a gangrene, may alfo increafe a gangrene, fo as to become a fphacelus.

S E C T. CCCXCII.

IF the inflamed part is glandular, the internal or external heat great, the obstructing matter thick and inactive by obstructing the emunctories of the glands, and by distending their follicles or cells, and their sides or membranes, it produces a hard indolent tumour of a gland, which is called a *scirrhus*, and is the fourth manner in which an inflammation terminates.

We come now to the last way of terminating an inflammation; namely, when an inflammation is not resolved, nor the obstructed parts separated from those adjacent which are sound: in which case therefore the morbid will remain united to the sound parts in such a manner, that no future endeavour of nature, nor any of the present known assistances of art, can dissolve it; but it can be no otherwise removed, than by the knife or by fire. But in those parts of the body, in which the blood passes every moment with a rapid motion through the vessels, it is evident, that the obstructed matter cannot long remain without some alteration: for by this continual struggle betwixt the impulse of the blood and the re-action of the vessels, either the obstructing matter will be removed, digested into laudable matter by suppuration, or else corrupted in a little time so as to form a gangrene or a sphacelus. But when such is the structure of the affected part, that the arterial blood passes through its vessels with little or no force, then there is danger lest the obstructing matter, being gradually deprived of its more fluid parts, will remain there immoveable, and form a hard indolent tumour which we call a scirrhus. But this way of terminating an inflammation is most frequently observed in the glandular parts, whose emissaries or excretory ducts being

obstructed, none of the secreted juices separated by the fabric of the gland, can escape, and these therefore being accumulated and inspissated by stagnating in the cavities, or in the vascular compages, will fill and distend them: and as the circulating humours cannot here exert their impulse upon this impacted matter, it will there remain deprived of its more fluid parts, and form an induration or scirrhus, of which we have a notable instance in an inflammation of the breast. For the milk separated from the blood, brought by the mamillary arteries, and stagnating in the lactiferous ducts, begins to coagulate; in the mean time the thin serum distils from the ducts of the nipple, and the residuum remains inspissated, and in a manner out of the course of the circulation; whence after the inflammation is gone off, such a hard indolent tumour often remains, during the rest of the patient's life. From hence likewise a scirrhus of the testicles often follows, after an inflammation of them: for if we consider that the very small spermatic artery, which arises from the trunk of the aorta, sends out small branches, which communicate and transmit the red parts of their blood by real anastomoses into similar small veins, and then spends itself in an infinite number of convoluted small branches placed orderly, and composing the substance of the testicle; it will evidently appear from thence, that the impulse of the arterial blood upon the obstructed vessels, is here little or nothing; whence the obstructing matter being once impacted or fixed in these glands, it proves very stubborn, and forms a tumour inflexible to all means whatever. But a scirrhus follows an inflammation in a glandular part, more especially when attended with the following circumstances.

[A great heat whether external or internal.] Women in childbed often commit the cure of their inflamed breast to their nurses, or to some old woman, who is often crazy enough; and as they fear nothing more than a suppuration, and an opening of the suppu-

rated part by the surgeon's lancet, they therefore use all their endeavours to prevent it. If indeed they endeavoured to disperse the inflammation in time by the application of emollient fomentations, they could not be much blamed: but, on the contrary, they, by a dangerous error, expose the inflamed breast to the heat of a burning coal, or else continually foment it with very dry and hot linen cloths, or else they apply spirit of wine almost scalding, by which means instead of a suppuration following, the more fluid parts are exhaled, and the rest of the matter inspissated into an irresolvable scirrhus; and then the unhappy woman who was so much afraid of a slight puncture with a sharp lancet, is frequently obliged afterwards to undergo the very severe and dangerous operation of amputating. The same disorder also frequently follows from the same causes, when the inflammation of a glandular part is accompanied with a violent fever.

The obstructing matter thick and inactive.] Since milk contains so large a quantity of a thick cheese like crassamentum, which easily separates by stagnation from the thinner serum by which it was diluted; therefore a scirrhus more frequently happens in the breast, than in any other part. When the foeculent or grosser parts of the blood are deprived of their more fluid juices, constituting what the antients call *atra-bilis*, which infects the mass of humours almost with the tenacity of pitch, in that case the slightest obstruction in glandular parts degenerate into scirrhii, as we shall declare hereafter in the commentary on § 485.

Obstructing the emunctories of the glands. &c.] All those juices which have been secreted by the fabric of the gland from the affluent blood, ought to be discharged through the excretory ducts of each gland for their determinate uses. If now the discharge of the secreted juice is by any cause obstructed, it will consequently be accumulated and distend

the follicule or cell in which it was contained; and the most fluid parts of that fecerned humour being either dissipated or absorbed, the remainder will be inspissated and rendered impervious. Now the impetus of the circulating humours may very well act upon the vessels which compose the membranes of the distended follicule, but not at all upon the matter contained in its cavity; whence it is evident, that the matter will remain there irresolvable, frequently by any artifice. But the more fluid parts being dissipated, even the thinnest of our juices may by stagnation concrete in a surprizing matter, as we are well assured. The bile which stagnates in its vesicle, does often thus concrete into stones whenever its excretory duct is obstructed. Even the urine which is more limpid, gives rise to the stone by being too long retained: and it will be made to appear hereafter, in the history of calculi, that such stony concretions are also formed sometimes in the ventricles of the brain, in the cavity of the abdomen, &c. which parts are nevertheless furnished only (in their natural state) with a very thin dew exhaling from the smallest arteries. The internal surface of the nose in an healthy person being well cleansed, discharges a very thin lymph; but after this humour has stagnated for some time, and exhaled its more subtle parts, it then acquires the toughness of a skin. Many more instances of the same nature might be alledged, but these are sufficient to prove, that very thin humours in the body may give rise to the worst concretions.

S E C T. CCCXCIII.

THE prognosis of an inflammation is deduced from considering its cause, part affected, magnitude, depth, violence, the habit of the patient, the several symptoms; and by comparing these

these with the demonstrative signs, and effects or consequences of the inflammation.

We have now considered the various signs and events of a present inflammation, and it therefore remains for us in this place, to enquire into its prognosis which determines the good or bad event which we may reasonably expect. But in order to know whether an inflammation inclines either to a salutary dispersion, a mild suppuration, a gangrene, or a scirrhus, we ought to consider the following particulars.

The cause.] Thus, for example, the contagion of the small pox so alters the habit of the most healthy person, that in three days time the whole surface of the external skin, and often that of the œsophagus, stomach, &c. is beset with inflammatory pustules: but in this case a resolution can never be expected, but a suppuration always, or in the worst species a true gangrene follows. But from the contagion of the measles, the external skin is inflamed indeed, but a suppuration never follows, and the disorder terminates in a scaling off of the cuticle. All authors who have attended people in the plague, have observed that inflammations arise in different parts of the body, which are sometimes so severe, that the inflamed part is in a few hours time burnt up to a crust, which is afterwards separated or cast off from the other sound parts by a suppuration of matter formed round its circumference. It is therefore apparent, that a very different event of an inflammation is to be expected, according to the variety of causes from whence it may arise.

Part affected.] Namely as it is more or less necessary towards life and health. Thus, for instance, in the hand, an inflammatory tumour, though violent, may be easily supported; but if a slight inflammation and tumour should be seated in the membrane which invests the parts about the glottis, or its rima, the patient

tient will then be suffocated in a little time. If a phlegmon turns to a gangrene either in the hand or foot, the mortified part may then be separated from that which is living; but if the like disorder is seated in the brain, it is evident there can be little or no hope. But there is not only a more or less danger, according to the different nature of the affected part, but also the way of terminating an inflammation is also very different on the same account. In a glandular part there is danger of a scirrhus; but in those parts of the body where there is much fat, an inflammation frequently terminates in abscesses and fistulæ very difficult to cure; as, for instance, about the anus, &c.

[Magnitude.] For the larger the space which the phlegmon occupies, the more numerous are the obstructed vessels, and the greater is the quantity of the impervious fluids in those vessels: and at the same time the velocity of the circulation through the other vessels which remain pervious, is proportionably more violent, as was observed in the commentary on § 382. numb. 8. But all these circumstances are repugnant to those conditions necessary for resolving an inflammation, (see § 386.) and therefore a suppuration or a gangrene is to be always expected in such a case.

[Depth.] It was demonstrated in the commentary on § 374. that almost all parts of the body are capable of inflammation, which is in no part more frequently and obstinately seated, than in the tunica adiposa. Therefore a deep inflammation must be either seated in this membrane, or in other parts. If it is seated in the fat, which insinuates itself very deeply betwixt the muscles, then the efficacy of external remedies can scarcely penetrate so far; and if a suppuration or a gangrene follows from such an inflammation, it will be very difficult to deterge or cleanse the parts. But if the inflammation is seated in the tendons, muscles, vessels, membranes, periosteum, or in the bones themselves; it is then evident for the same reasons,

reasons, that its cure must be difficult. But what bad consequences may follow from an inflammation of the viscera themselves, we shall hereafter declare, when we come to treat of acute or inflammatory diseases.

Velocity.] While the impervious humours stagnate in the impervious vessels, the blood which is impelled into them by the remaining *vis vitæ*, produces certain effects, which are also at the same time the signs of inflammation, enumerated in § 382. But if these increase suddenly, if the redness, tumour, heat, pain, &c. increase in a moment, we may easily foresee that the tender vessels will be ruptured in a short time, and that we are by no means to expect a resolution, but a speedy gangrene; (see § 386.) and therefore a sedate motion of the humours is reckoned among those conditions which are required to disperse an inflammation; and, on the contrary, a swift motion of them denotes a suppuration or a gangrene to be at hand.

Habit of the patient.] Every individual person has his particular healthy state; and although the disposition of the solids and fluids appear very different in two several people, yet we often see that both of them enjoy a perfect state of health; but in such a manner, that one of them is inclined to one sort of diseases, and the other is more inclined to another sort of diseases. The rustic who has been inured to hard labour can hardly escape from a pleurisy, because his blood is very compact or thick, and his vessels being rigid, there is little or no hope of obtaining a mild resolution; but in those who are of a lax and weak habit, such inflammatory diseases are much more easily cured. But the morbid as well as the natural habit of the patient makes an inflammation terminate variously: thus the cold and phlegmatic are seldom troubled with inflammations, which are but slight, if they ever invade; but if a putrid scurvy should have infected the humours, the least inflammation, or the slightest

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lightest wound often degenerates into the most stubborn ulcer, or a gangrene.

Symptoms, &c.] Of these we treated at § 382. et seq. From considering, all which, one may foresee what event is to be expected from the inflammation, and thus the prognosis is absolved.

S E C T. CCCXCIV.

IT is also apparent that the curative indications will be different according to the different state of the disorder.

We come now to deduce the curative indications from all that has been said before, in order to direct us to the means proper to remove the known disorder. But nothing is of more pernicious consequence in medicine, than to prescribe a general method of cure to a disease, without having a regard to the particular state, and various circumstances of it. Thus in fact we have different diseases which come under the denomination of a pleurisy; and which though they are alike in their beginning, yet do they often differ widely as they increase, and require a very different method of cure. And again the same pleurisy requires to be treated in a different manner at its beginning from what it does when it has continued for some days, and afforded manifest signs of an incipient suppuration. There is therefore no general method of cure to be prescribed to an inflammation, but it requires a different treatment, according as it inclines to terminate in this or that manner. It is indeed true, that an inflammation ought always to be removed if possible by a resolution, when that seems practicable; but if, for example, there are signs of a gangrene, the only method that remains is to separate the dead from the living parts, by procuring a suppuration, to promote which, all the curative

rative intentions are to be directed entirely to that end: and so long as there are any hopes of a resolution, all the endeavours of art are to be used to prevent a suppuration, especially when the inflammation is seated in some internal part of the body. It will therefore be proper to consider these four methods of terminating an inflammation separately, and to describe the treatment proper to each. In the first place, therefore, we shall treat of the cure of an inflammation by a resolution; that is, by reducing the concremented and stagnant matter of the inflammation to a state of fluidity and motion.

S E C T. CCCXCV.

FOR if any of the causes (375, to 379.) have produced an inflammation (371) in any part (372, 373, 374, 379,) which is attended with the symptoms (383, 384,) and primary conditions (386) then the following indications arise.

1. To prevent further injury from being offered to the vessels.
2. To remove that injury which they have already suffered.
3. To render and preserve the obstructing matter fluid and mild.
4. Or, if that cannot be performed, to repel the matter back into the larger vessels.

As this distinction will be so highly useful in the cure of a pleurisy, peripneumony, quinsy, and the like diseases, therefore each of these particulars are to be well considered.

The condition of the disease whose cure we shall presently describe, is very exactly determined in this text. For from whatever cause the inflammation

tion arises, or whatever part of the body it occupies, whether external or internal, a resolution of it may be always attempted, provided it is recent, and attended with those circumstances which are enumerated in § 336. And thus may the inflammation be terminated, when there is a possibility of performing what is mentioned in the four following numbers.

1. To resolve an inflammation, it is required to reduce the concremented or obstructing matter to a state of fluidity; and reconcile the stagnating humours to their proper motion; as we observed before at § 386. But if the continuity of the vessels is not preserved, the humours extravasated from the broken vessels will necessarily stagnate and corrupt: but in every inflammation there is a tumor from the distention of the vessels, and a pain from the distraction of their fibres; approaching near to a rupture, both which denote that if the same causes continue to act, the vessels will then burst; but when the continuity of the vessels is dissolved, a suppuration follows, or else a gangrene, if that solution of their continuity happens very suddenly. It is therefore evident, that in order to resolve an inflammation, it is necessary to prevent any further injury of the vessels.

2. So long as the inflamed vessels remain entire, their injury consists in too great a dilatation, and a distraction of their sides, by the impulse of the vital humours against the obstructions: if therefore this too great distention of the vessels is removed, this indication will then be satisfied.

But the two preceding curative indications relate to the solids, and those which follow respect the fluids.

3. The concremented or impervious fluid stagnates in the obstructed vessels; and as an inflammation can take place only in the arteries, (see § 371.) the impulse of the humours urging behind, will always drive the obstructing matter further into the narrow parts of the vessels; it is therefore required so to attenuate this matter, as that it may be capable of passing
through

through the smallest extremities of the obstructed vessels. But a bare attenuation of the concremented fluid will not suffice, unless the mild or unacid state of the humours is also preserved; for concremented blood may indeed be resolved by a putrefaction, but then it also acquires a great acrimony. But an acrimony mixt with the blood which is in this case rapidly moved through the tender vessels, already weakened by too great a distention, would destroy them in a very little time; whence a gangrene would then follow instead of a mild resolution: for it was demonstrated in the commentary on § 388. that an acrimony of the humours causes an inflammation to tend speedily to a gangrene. It is therefore hence apparent, that the mild state of the humours must be preserved, besides reducing them to a state of fluidity.

4. Sometimes the orifices of the vessels are so dilated as to admit such gross particles, that we can scarce hope to attenuate them, so far as to procure a free passage of them through the smallest extremities of the obstructed vessels. Thus the red blood enters the pellucid vessels, even of the cornea itself in the worst species of an ophthalmia, whose vessels are much more minute than those of the adnata tunica; but those vessels in their natural state, will exclude all such parts of the blood as have any colour. So that although the red impervious blood which stagnates in these vessels, should be resolved into serum, and that serum again into lymph, which is a degree thinner, yet its particles would not be capable of pervading the smallest extremities of these very minute vasculæ. There is therefore but one means left in this case to resolve the inflammation; namely, to repel the obstructing particles, from the narrow ends of the vessels into which they are impacted, towards their larger bases, and from thence into the larger vessels; so that being returned into the circulation, the obstructing matter may be resolved by the motion and attrition

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trition of the vessels, and of the other contiguous particles.

S E C T. CCCXCVI.

ANY further damage to the vessels is prevented :

1. By removing or correcting the known causes (375 to 380.)

All that art can do in the cure of diseases, is to restore the parts to their healthy state; but the causes, which are enumerated in the aphorisms here cited, are such as may cause an inflammation even in the most healthy person; and therefore all endeavours will prove fruitless, unless these causes can be removed: as for instance, when an inflammation arises about the os sacrum and coccyx, from a person's lying too long on his back, it will not be possible to prevent that inflammation from turning to a gangrene, unless the pressure of the incumbent weight of the body can be taken off; and the same is also apparently true with respect to the other causes of inflammation.

2. By diminishing the force of the arterial blood by bleeding and purging.

There are two things which concur in the definition of an inflammation, as explained at § 371. namely a stagnation of the arterial blood in the smallest vessels, joined with a pressure and attrition from the rest of the blood, which is more strongly urged into the obstructed part by a fever. Now the imperious blood stagnating in those vessels indeed causes an obstruction, but there is from thence no further injury offered to the obstructed vessels, if they are not urged or distended by the impetus of the blood acting

ing behind. Therefore the chief thing required to prevent the inflamed vessels from suffering any further injury, will be so to diminish this impetus, as that the vessels can be neither ruptured nor more distended by the arterial blood; whose motion cannot be totally removed, and at the same time continue life in the part; but yet it may be rendered so gentle as to do no further damage. But this is obtained by

Bleeding.] It was said at § 381, that the remaining life produces certain effects in the obstructed parts, which were at the same time the signs of an inflammation: but the malignity of an inflammation is to be measured by the number and magnitude of these effects, which also indicate in what manner the inflammation will terminate. When therefore the *vis vitæ* is diminished or rendered less active by any cause, those effects, which result from the impulse of the vital humours into the obstructed vessels, will be diminished. Now we are capable of diminishing the impetus of the blood to any degree which we please, even until death or a perfect rest barely by bleeding; and therefore we may restrain the force of the circulation more or less according to the degree of this evacuation. *Helmont*^a and many others after him have banished this wasting of the blood as useless and pernicious in the cure of inflammatory diseases: for they believed, for instance, that a pleurisy arose from an hostile acid, fixing itself like thorns into the intercostal membranes and vessels: and therefore, cried they, bleeding is to no purpose, but we must remove the pleuritic spiculæ; the bloody Moloch prevailed over the medicinal professors, who then taught that this disease was to be conquered by specific remedies, and not by weakening the strength with bleeding, etc.^b But it is evident from what has been said before, that these pleuritic spiculæ are nothing more than the impervious blood hesitating in the small ar-

^a *Helmont. in capit. Pleura furens, pag. 319. n^o. 13.*

^b *Ibid. pag. 322.*

teries, and that the humours, urging on the back of these obstructions, drive in their spiculæ, that is, produce a pain from the distraction of the fibres. It is indeed true, that a perfect cure might be obtained, if the impervious blood, which there hesitates, can be instantly dissolved, and reduced to a state of fluidity: but whether or no Helmont could effect this by his boasted specifics, such as goat's blood dried and reduced to a powder, especially that which was discharged from cutting off the testicles; the stag's pizzle, wild poppy flowers, *etc.* will appear very doubtful to one who reads how little serviceable they proved to himself in the like disease, as he relates towards the end of the same chapter. As therefore there has not been any remedy as yet found, which deserves to be trusted as a specific for resolving immediately the stagnant and impervious blood in this disease, whether externally or internally applied; therefore nothing more useful can be done, than to prevent the further ingress or protrusion of the obstructed matter into the more narrow parts of the converging vessels, and at the same to prevent it from growing more compact and firm: but both these intentions may be obtained by diminishing the force of the arterial blood, which may be most commodiously and safely performed by phlebotomy, as also by

Purging.] For next to bleeding this evacuation most effectually diminishes the force of the blood. In the *materia medica* corresponding to this aphorism, you have a list of those purgatives which act without much increasing the motion of the blood, and which even attenuate or dissolve our humours at the same time. This method is even recommended by Sydenham, who diligently inculcates the same in his *Schedula Monitoria* concerning the coming in of a new fever at that time, which treatise he wrote towards the end of his life, after he had spent thirty years in the practice of physic, and in diligently observing the course of nature in diseases. He there treats of an
 inflammatory

inflammatory fever, with a sudden determination of the morbid matter towards the brain: and after premising phlebotomy, he prescribes a purging draught *ex tamarindis, rheo, senæ foliis, manna, etc.* and in the evening he gave a gentle paregoric to quiet the disturbance from the purge, though but slight. He repeated such a purge every other day to the third time, and by that means happily cured the disease, which was of its own nature dangerous enough; but he diligently observes, that these purgatives were prejudicial, unless phlebotomy had been premised.

But it is very evident, that all these assistances of art are not required in every inflammation, but only in those cases, where the continuity of the affected part, being absolutely necessary to life and health, will not admit of any other way of terminating the inflammation; or unless the inflammation is seated in such a part of the body, as will not admit of discharging the matter after a suppuration is made, from whence the most fatal consequences might be expected.

3. By diminishing the quantity of the humours by the same means.

It was said in the commentary on § 378, that one of the most frequent causes of inflammation was too great a dilatation of the lymphatic arteries, by which they admit grosser parts of the blood than are able to pass through their small extremities. Also in the commentaries on § 106. numb. 4. and § 118. it was demonstrated, that a plethora is one of those causes, by which the orifices of the vessels are dilated: since therefore bleeding and purging diminish the quantity of the humours, they will serve to remove those causes of inflammation. Besides this, the quantity of fluids being diminished, there will be a less compressure and cohesion of the particles of the blood to each other; from which compressure the inflammato-

ry spiffitude of the blood very frequently arifes. For if the blood impelled from the heart was to run into the arteries in an empty ftate, it would there meet with no refiftance, and confequently could fuffer no compreffure: but when the heart forces out its blood into full arteries, thofe arteries muft either be dilated, or the blood contained in their cavities muft be compreffed, but the arteries refift dilatation the more as they are fuller, and therefore in that cafe the blood will be condensed or thickened. Therefore for this reafon an inflammation is juftly reckoned among the effects of a plethora § 106. numb. 4. and therefore by diminifhing the quantity of the fluids moving in the veffels, the body is rendered very much averfe to inflammation; and it rather inclines to an oppofite diforder, namely a dropsy, which ufually follows profufe evacuations.

4. By making a revulfion of the blood's force into other parts by fuction, friction, fynapifms, blifters, fomentations, warm bathing, iffues, fe-tons, and ftrohg purging of the bowels.

These artifices were constantly ufed by the wife an-tients, as appears from the monuments which they have left us. Hippocrates^c, in treating on a quinfy, fays, *Sic affectis à venis, quæ in brachiis funt, fanguis detrahendus eft; fimulque alvus fubducenda; ut, quod morbum exhibit, id avellatur, etc.* “ In thofe who are
 “ thus affected, blood is to be drawn from the veins
 “ of the arms, and at the fame time the bowels are
 “ to be loofened or cleaned, in order to draw off
 “ the matter which caufes the difeafe,” etc. And thus Galen^d recommends a revulfion, where he treats of curing the head-ach; *Revulfionem in totum corpus acribus clyfmatibus, et vinculis, ac multis infernarum*

^c De locis in homine. cap. 11. Charter Tom. VII. pag. 370.

^d Galen. de Meth. Med. ad Glaucon. Lib. I. cap. 16. Charter. Tom. X pag. 364.

partium frictionibus ; sanguinis etiam nonnikil, si ita necessitas urgeat, detrahendo. Parti autem medemur, interim dum in totum corpus revellimus, ea capiti inspergentes, quæ repellendi vim obtinent, etc. " A revulsion is
 " to be made in the whole body by sharp clysters, li-
 " gatures, and repeated frictions upon the lower
 " parts ; and also by taking away some blood, when
 " that shall be found necessary. But in the mean time
 " we make a partial relief, while we procure the
 " general revulsion by the asperision of those things
 " upon the head, which have a repelling force."

There are many more passages of the like nature which occur in the same authors, from whence it appears, that they had much confidence in revulsions towards the cure of many diseases. Helmont, who opposes the antients almost in every thing, laughs at these trifles of revulsions ; and even since the time of Harvey many have refused their assistance, as being either useless or repugnant to the known circulation of the blood. But the use of revulsions in diseases is confirmed by daily experience as well as by reason ; for so soon as the resistance to the blood's motion is either diminished or totally removed in any part of the body, it immediately flows or is derived into that part with a greater velocity. Thus if an artery even but of a moderate size be divided, all the blood will flow through that vessel which does not resist. When all the vessels and viscera of the abdomen are suddenly freed from a considerable pressure by the birth of an infant, all the blood is frequently derived into those vessels so forcibly, that unless the flaccid vessels and viscera are compressed by swathing with a roller, the child-bed woman may suddenly perish in a fatal swoon for want of the blood's due pressure in the vessels of the brain and cerebellum. The same thing also happens if the abdomen is not swathed, when all the water is discharged at once by paracentesis in a dropsy. It is therefore evident, that by diminishing the resistance in any part of the body, the

blood will be derived thither more forcibly and plentifully. But the fulness of the vessels, and the strength of their coats, resist the impulse of the blood from the heart, which are impediments to their dilatation; and therefore every thing which lessens the fulness of the vessels, or occasions their sides to yield more easily to the distending blood, will derive the humours more powerfully and copiously into that part. If again we consider, that the blood propelled by the heart is sent partly upwards to the head, and superior parts of the trunk, and partly downward to the lower extremities and viscera; it will be from hence evident, that by diminishing the resistance of the lower vessels, or by evacuating them, the quantity and impulse of the blood will then be derived more towards the inferior parts, and drawn from those which are superior. It is therefore possible to make a revulsion of the arterial blood from an inflamed part to any other; especially when the part, towards which the revulsion is made, receives its blood from the same common trunks or larger arteries. Thus physicians foment the external parts of the head in inflammatory disorders of the encephalon, that the impulse of the blood being increased in the branches of the external carotide, it may urge with a less force upon the parts contained in the head. When the callosity of a fractured bone is too luxuriant, (see the commentary on § 357.) Celsus tells us, *Quod conferat aliquid de sinapi cum ficu in alterum pariter membrum impositum, donec id paululum erodat, eoque vocet materiam*; "That it will be of some service to apply a fig and mustard to the opposite limb, till it has corroded the same in a small degree, and drawn thither the matter." But all revulsives either relax the vessels, or empty them by friction or a more frequent contraction excited in the vessels by the application of things which stimulate upon the part, towards which the revulsion is to be made. But a revulsion is procured chiefly by the following means:

By

By suction.] Which is best of all made with cupping-glasses, by the use of which the pressure of the atmosphere is removed from the part of the skin to which they are applied, or at least its pressure is by that means considerably diminished, whether the air be drawn out by sucking or by the air-pump, or by much rarefying and expelling a great part of the air contained in the cupping-glass by burning flax. So soon as the equable pressure of the air is taken off from the surface of the skin under the glass, all the vessels are more distended, the part swells and looks red, and if the glasses are continued to be applied for a considerable time, a true inflammation may follow, or even a gangrene. Galen^e has long ago observed, that pains are eased almost as with a charm, by making a revulsion with cupping-glasses. Hippocrates^f has ordered the application of a very large cupping-glass to the breast to lessen the menstrual flux. And I have seen violent inflammations of the eyes cured barely by the application of cupping-glasses, when scarce any other remedies would take any effect. And of what considerable use cupping was in the like diseases among the Egyptians, may be seen in Prosper Alpinus^g.

By friction.] By friction the veins, which yield more easily to pressure, are therefore more especially emptied; whence the arteries, which correspond to those veins, will more easily discharge their blood into the emptied veins; therefore the resistance of the blood flowing into those arteries will be diminished: whence it will be derived thither with a greater impetus and in a greater quantity, as is evident from what has been said before. For this reason any part of the body may by friction only grow hot, red, and become inflamed; and if the friction is continued, the increase of the blood's heat and motion will be com-

^e Meth. Med. Lib. XII. cap. ult. Charter. Tom. X. pag. 292.

^f Sect. V. Aphor. 50. Charter. Tom. IX. pag. 224.

^g De Medicina Ægypt. Lib. II. cap. 14.

municated throughout the whole body: and for this reason Celsus^h condemns friction long continued in acute diseases, when he says, *Longa vero frictione uti, neque in acutis morbis, neque incrementibus convenit; præterquam cum phreneticis somnus ea quaeritur*; “ But
 “ the use of long continued frictions is neither pro-
 “ per in acute diseases, nor in those which are in-
 “ creasing, because it induces both a phrenzy and a
 “ sleepiness.” And a little after, speaking of the use of friction, he says, *Nam et capitis longos dolores ipsius frictio levat; non in impetu tamen doloris: et membrum aliquod resolutum ipsius frictione confirmatur. Longe tamen sæpius aliud perfricandum est, cum aliud dolet: maximeque cum à summis, aut à mediis partibus corporis materiam evocare volumus: ideoque extremas partes perfricamus*; “ For friction also eases inveterate
 “ head-achs, but it is not to be applied when the
 “ pain is most severe: and a paralytic or weak limb
 “ becomes stronger by a friction of it. But when
 “ one part aches, it is much more usual to make the
 “ friction upon another part more remote, and espe-
 “ cially when we intend to call off the morbidic mat-
 “ ter from the upper or from the middle parts of the
 “ body; for in that case we make frictions upon the
 “ extremities.”

Synapisms or epispastics.] Thus are called those remedies, from their drawing power, because they derive the humours in a greater quantity, and with more force into the parts to which they are applied. Now although every thing, which relaxes and weakens the vessels in any part of the body, may be termed attractives, because a relaxation of the vessels gives a more easy entrance to the humours; yet by this name we generally understand those topical remedies, which irritate the vessels of the part to which they are applied by an acrid stimulus, so as to make them contract more frequently and more powerfully, that is, they accelerate the motion of the vital humours

^h Lib. II. cap. 14. pag. 89.

through their vessels. These attractive remedies have received various denominations, according as they possess a greater or less acrimony. Those which only excite a redness in the part to which they are applied, are termed *phænigmi*; but if they excite a great redness with heat, itching, and a tumour in the part, they are usually called *synapisms*, because ground mustard-seed, being applied to any part of the body, produces all those appearances: if they are yet more acrimonious, and raise the cuticle into blisters, they are then called *vesicatories*; or if again they produce the effects of fire upon the part by their strength, they are termed *caustics*. All these excite a true inflammation in the part to which they are applied, and if they are very strong, they may increase that inflammation even into a *gangrene*. But what efficacy all these have to derive the impetus of the blood towards other parts, is taught by daily observation and practice. If the feet of a person, who is ill with an acute phrenzy, be involved in a paste made with ground mustard-seed, scrapings of horse-radish, or the like, the disorder will frequently be relieved in a few hours, and the patient will begin to come to his senses by the pain and inflammation thus produced. When nature endeavours to separate any offensive matter from the whole mass of blood, and to deposit it upon some particular part of the body, physicians then usually determine the wandering matter towards a part, where it will be the least offensive, by applying *epispastics*; and this they do often with very good success. Thus in the small-pox, when the legs and feet have been fomented with emollient decoctions in the beginning of the disease, and these *epispastics* afterwards applied to the soles of the feet, I have frequently seen, that the pustules have gathered extremely thick in the lower parts of the body, when at the same time there were but very few eruptions in the face and upper limbs.

Vesicatories.] These, as we said before, are yet stronger than epispastics, and separate the cuticle from the skin of the part to which they are applied, raising it into blisters, distended with a thin liquor, whence they derive their name. Every thing, which can excite the most violent inflammation, are also vesicatories; for when an inflammation turns to a gangrene, these little blisters of the cuticle afford almost the first sign of the incipient gangrene: and in the same manner actual fire raises the cuticle into blisters. Hence the most acrimonious remedies, such as the *ranunculi pratenses*, *hydropiper*, *sedum minus acre*, *etc.* being either applied in too great a quantity, or continued too long upon the part, they raise blisters in the skin. But of all this tribe of remedies, *cantharides* are the most frequently in use; which dry and juiceless insect I have known to retain its force of blistering, though kept in a glass negligently stopt for the space of above thirty years. *Cantharides*, being grossly pulverized, and mixed with some sticking plaister, or with some dough of which they make bread, and applied to the part towards which the revulsion is to be made, are suffered to continue there for the space of eight or ten hours, within which time they usually elevate the cuticle into a blister. But if the *cantharides* are left too long upon the part, they often excite intolerable pains by irritating that nervous pulp, which lies immediately under the cuticle; and sometimes they even excite a severe strangury and bloody urine.

But as all these things have a powerful acrimony, and frequently increase the velocity of the blood throughout the whole body, by irritating the part to which they are applied, (which yet is a circumstance repugnant to the indication in this case, as is evident from numb. 2. in this aphorism,) therefore great caution is always necessary in the use of them.

Fomentations and warm bathing.] These are usually composed of water, with the addition of such things

things as are emollient or relaxing. But all of them act by relaxing the solids, so as to diminish the resistance of the vessels, whereby they will be more easily dilated, even though the distending cause remains the same. The most efficacious of all these are baths of warm vapours; for a part of the body, being exposed for a quarter of an hour to the vapours of warm water only, begins to swell. But when a revulsion is to be made towards such a part of the body, which cannot be conveniently immersed in the bath, fomentations may then suffice, provided they are retained warm.

Issues.] The skin is here divided with a lancet down to the panniculus adiposus, or else corroded by the potential cautery in those who are afraid of the knife. The wound thus made is filled with a little ball of gold, silver, ivory, or any other matter which is not easily changed, and then covered with a sticking plaster to prevent the globule from slipping out of the wound. Thus a foreign body, being interposed betwixt the lips of the wound, prevents their concretion, and at the same time a slight contusion and irritation is made throughout the whole compass of the wound by the hard body, which makes a daily slight inflammation in the part, towards which the impulse of the arterial blood must be therefore derived. These issues are chiefly serviceable to those patients who have their solids so weak or flexible, that the least excess of the blood's impetus dilates their vessels, which permit the grosser parts of the blood to mistake their course. Thus, for instance, those who have an inflammation of their eyes upon every slight occasion are very frequently relieved by issues. But when a violent inflammation suddenly invades any part, it is evident enough that issues will be useless; for the part affected may be long corrupted by a gangrene before issues can be supposed to produce any effect. The same is also true of

Setons.]

Setons.] These are generally placed in the nape of the neck, where the skin and panniculus adiposus being taken up with a pair of pleyers for the purpose, the surgeon then perforates them with a large needle, armed with a large thread which he leaves in the wound, and which being daily drawn through the wound, irritates and excites a continual inflammation in the part where the seton is fixed. These are of the same use with issues, but they generally have a more considerable effect, as they produce a greater pain and irritation. I have seen the most obstinate head-achs cured by the revulsion which a seton makes, when they have proved inflexible to all other remedies; and there are many instances which occur in the best authors confirming the same thing. We have a remarkable case of this nature related by Ruyfch^h, of a girl eighteen years old, of a sanguine habit, who was continually tormented with an intolerable head-ach. The most efficacious remedies usual in these cases were tried without success, such as purging, repeated phlebotomy, blisters, sternutatories, cupping-glasses. Even a large wound had been made in the integuments of the head by a crucial incision, which was attended with a considerable hæmorrhage, but without success, insomuch that some eminent surgeons had thoughts of trepanning the cranium. But before they proceeded to this last and severe remedy, Ruyfch proposed the application of a seton, which being made, the pain presently vanished: and the patient being tired with its troublesomeness, took out the thread, whereupon the pain which had been hitherto dormant, again revived; but a new seton being made, it presently disappeared; but even a third time the seton being healed up, the most troublesome head-ach returned, which again yielded to a new seton.

Strong purging.] How serviceable it is in inflammatory diseases to diminish the quantity and impulse

^h Observat. Chirurg. n. XL. pag. 39.

of the humours by purging, and what purges are proper for that purpose has been already declared at numb. 2. of this aphorism. But it is to be observed, that the same evacuation may be likewise useful as a revulsion, to drive the impetus of the blood from an inflamed part, especially when the disorder is seated in the upper part of the body. For so powerful a derivation may be made through the mesenteric vessels towards the cavity of the intestines, that there hardly remains any pressure of blood in the vessels towards the encephalon; insomuch that the stronger purges frequently occasion a vertigo, and even fainting by this same means. When the whole tunica adnata looks red in an ophthalmia, by the entrance of the red blood into the smaller vessels; in that case, by giving a strong purge, the blood is repelled back into the larger vessels, while a paleness invades the face and eyes, whence a speedy and happy cure is frequently made. Clysters frequently thrown into the bowels do often produce the same effect, partly by relaxing the vessels, and partly by driving the impetus of the humours that way, by a gentle stimulus. Hippocratesⁱ treating on the cure of a pain in the ear, after having ordered the application of cupping-glasses on the opposite part, to turn off the afflux, he says: *Si hæc nihil juvent, medicamentum propinandum sit, quod deorsum purget; sursum vero minime, cum vomitus nihil conferat, etc.* “ If these avail no-
 “ thing, a medicine is to be given which will purge
 “ downward, but by no means upward, since vomiting
 “ is of no service,” *etc.* And a little after, treating of an ophthalmia, he adds: *Si subitissime (oculi) inflammationem conceperint, nihil omnino illine; sed vel fortissime in inferioribus partibus inurito; vel alio quopiam abum ducente medicamento extenuato; cavendo ne vomitum facias;* “ If the eyes are suddenly taken with
 “ an inflammation, do not anoint them with any
 “ thing at all, but make a powerful cauterization in

ⁱ De locis in homine, cap. 6. Charter. Tom. VII. pag. 364.

“ the lower parts, or reduce the habit by giving some other medicine which purges the bowels, taking care not to make the patient vomit.” From whence it is evident, that the ancient physicians used purges to make a revulsion from inflamed parts, and that the purges were of that nature as to act strongly; since Hippocrates in this place uses the term which denotes an extenuation or wasting of the body, and a collapſion of the veſſels, by a powerful evacuation. But he orders vomiting to be industriouſly avoided in theſe caſes, becauſe in the act of vomiting the blood is derived more plentifully and violently towards the head; as is apparent, if a perſon looks at a man while he is vomiting; for the eyes look red and watery, the lips and whole face are diſtended and ſwelled with blood, *etc.*

5. By a dry and cool air, the affections of the mind, being either ſilent or very ſedate; by procuring a natural or artificial reſt to the patient; by uſing a thin, fluid, and cooling diet, with a drink of the like nature, and uſing diluent and cooling medicines at the ſame time.

This number treats of thoſe means by which the motion of the humours through their veſſels may be rendered the more ſedate, in order to hinder any further injury from being offered to the veſſels which are inflamed.

A cool and dry air.] That is cool ſo far as it is received into the lungs in reſpiration. For the blood propelled from the right ventricle of the heart, receives a great heat and attrition from the ſwiftness of its motion through the pulmonary artery, and therefore requires to be cooled by the air, as is evident from phyſiology. But if the external air is too hot, it cannot be then expected to cool the blood. Now it appears from experiments made on living animals,

animals, that a most acute fever may arise, barely for want of this cooling of the blood by the air, which proves fatal in a few minutes time, if the air in which those animals are included is very hot^k. It is therefore evident, that a cool air conduces much to moderate the swiftness of the circulation of the blood. But a dry air is to be preferred (*cæteris paribus*) before a moist air, which last, if cold, may cool the blood too much. For we constantly observe, that people are sensible of a greater cold in autumn or winter, when the air is moist, than when it is dry, notwithstanding the thermometer denotes the same degree of heat; which seems to follow, because the air which has little or no moisture, is sooner heated by the warmth of our bodies: for, in general, it is to be observed, that bodies grow hot sooner or later by the same degree of fire, in proportion as they are more or less dense, whether they be solids or fluids^l.

The affections of the mind either silent or sedate.] That the circulating motion of the blood may be very much accelerated by violent passions in the mind, is evident from daily and certain experience. But of this subject we treated in § 99. numb. 1. Whence it is evident, that these passions ought to be industriously avoided; or if they should arise, they are to be immediately quieted; the manner of effecting which has been said in the commentary on § 104.

By procuring natural or artificial rest.] How serviceable rest is in all diseases, in which there is too great a velocity in the blood's motion, has been said in the commentary on § 105. But when the mind is not decomposed by any passions, and nothing operates strongly upon any of the sensitive organs, a quiet sleep then usually creeps on of its own accord; for which end the ancient physicians caused their patients to lie in a dark place free from the least noise, in all acute or inflam-

^k H. Boerhaave Chem. Tom. I. pag. 275, &c.
^l Ibid. pag. 279.

matory diseases. But if this rest cannot be thus procured, after premising those means mentioned in the preceding numbers, we may then safely apply to the use of anodynes. See more on these remedies in the commentaries on § 202, and 229. numb. 2.

A thin fluid and cooling diet.] In order to restore those parts which are continually wasted from the body, by the unavoidable actions of life and health, it is required of us to be continually taking in aliments at proper intervals; and though these aliments are of the best nature which we can choose, yet they have always something of a foreign disposition, and therefore require to be altered into our own nature by the action of the vessels and viscera. But while this attenuation and change is made in our ingested aliments, if they are taken either in too large a quantity, or are not easily susceptible of that change, they excite a fever even in the most healthy people; by which means the inflexible matter which produced the fever, is either attenuated or discharged. Even every day the most healthy person may perceive an increase in the quickness of the pulse, some hours after dinner. But as those powers which are to change the crude aliments into good blood are weaker, so much more is the blood's motion accelerated by the ingested aliments. Thus if a weak girl should have dined upon flesh which has been dried in the smoak, upon fat bacon, or food of the like hard digestion, she will certainly be feverish within a few hours afterwards: and phthisical people who are gradually wasted by an hectic fever, even these perceive an increase of their fever, by taking more milk than usual. But as the assimilation of the ingested aliments into healthy animal juices, depends chiefly upon the action of the solids upon the fluids, and upon a considerable quantity of healthy ready formed juices, which are to be gradually mixed by a little at a time with the crude chyle; (see the commentary on § 25.) and as by bleeding and purging (prescribed at numb. 2, and 3.

of this aphorism for resolving an inflammation) the ready formed or concocted humours are evacuated, and the force of the circulation diminished; it is therefore evident, that the diet ought to consist of such things only, as are very easily attenuated and digested. Every thing therefore which can be easily changed into good chyle, even by a slight action of the chylicative viscera, and may be afterwards easily attenuated further, so as to form good blood, by the action of the lungs and arteries, will be here convenient: as the whey of milk, especially that sourish kind which is made from butter-milk: milk diluted with two or three times as much water, barley, or oat gruel, &c. with the juices lately expressed from garden fruits; these are in this case very useful, especially if taken in small quantities at a time, and frequently repeated: for by such a diet the body will never be oppressed, but will from thence be moderately cooled, which is extremely useful in acute inflammatory diseases. People have even a spontaneous or natural appetite to such cooling and thin aliments, when they are fatigued either with inflammatory diseases, or by the intense summer's heat, and they have an aversion to food of a contrary nature: but, on the other hand, a cooling diet would be directly repugnant in the winter time for chronical and languid diseases. And this doctrine we have expressed by Hippocrates, after his usual manner, in a very few words, when he says: *Imbecilles diætæ frigidæ, valentes vero calidæ*; "That the weak are to have cooling diet, but those who are strong and well, a diet that is heating^m.

Drink of the like nature.] The juice of citrons, oranges, cherries, currance, their syrups or inspissated juices, which are prepared by the confectioners, diluted with a large quantity of water, form a very pleasant drink; out of which you may make an agreeable variety, changing the ingredients, from whence those may be selected which are most pleasing to the pa-

^m Epidem. Lib. VI. textu 18. Charter. Tom. IX pag. 494.

tient, since almost any thin liquor will suffice for this purpose.

Using medicines which dilute and cool at the same time.] We have already seen, that the imperious blood stagnating in the smaller vessels, suffers a compression and attrition from the impulse of the humours urging behind, as is evident from the definition of an inflammation given in § 371; and we demonstrated in § 382. numb. 6. that this attrition is followed with an intense heat, therefore, to prevent any farther injury to the inflamed vessels, it will be convenient to use such remedies as may dissolve the obstructing or concremented matter by diluting, and at the same time remove the too great heat which arises. But, properly speaking, we have in this case but one diluent, namely water; since all other medicines are no farther diluents than as they contain water. But we said a little before, that thin and fluid aliments, or rather drinks, are here convenient; that is, as they contain more water, by which they conduce to dilution together with the medicines. But cooling medicines are such as diminish or remove the causes of too great heat; which too great heat accompanying an inflammation, was demonstrated (in § 382. numb. 6 and 8.) to arise from a greater attrition of the solids upon the fluids, and of the fluids upon each other, from an increase in the circulation in the inflamed vessels, as also in those vessels which remain yet pervious, but are more or less compressed or straitened by the distention of the adjacent vessels which are obstructed and distended. Therefore every medicine will be a cooler, which can remove the too great thickness of the fluids; which can relax the obstructed vessels, and which can diminish the too great impetus of the circulation, and therefore all watery liquors will be serviceable not only as diluents, but as coolers at the same time. For we observe that the habit of body is colder as it contains a larger quantity of water, and, on the contrary, that the blood is hotter as it is less dilute:

dilute: Hence all dropfical people are cold, but those who are robust, and addicted to exercise are very warm. But water is also serviceable at the same time, in as much as it relaxes the solid parts, as was said in the commentaries on § 35 and 54. Now the blood being diluted with water, and the vessels relaxed, the force of the circulation is thereby always diminished, as is very evident in weak girls, who so frequently fall into diseases from weakness, by the abuse of warm watery liquors. When therefore there are any hopes of resolving an inflammation, water is to be the basis of all the antiphlogistic medicines, to which farinaceous and emollient substances are to be added to relax the vessels still more; and to these, attenuating remedies are likewise to be joined, to divide the inflammatory concretions, and render them pervious. Various forms of these remedies may be compiled, of which you have some specimens given in the materia medica, corresponding to this number of the present aphorism. It is to be also observed, that bleeding and purging, of which we treated at numb. 2 and 3, of the present section, are also coolers in inflammatory diseases.

6. By quieting the impetus of the blood in the part itself, by the external application of remedies, which cool, repel, and astringe; to which may be added anodynes and aperients of various kinds, according to particular circumstances.

Hitherto we have been treating of those remedies which prevent any further injuries of the vessels, either by making a change in the whole body, or in some other of its parts; we are therefore now to treat of those which are capable of restraining the too great impetus of the humours, by an external application to the inflamed part itself. It was said before in the

commentary on § 382. numb 8. that the motion of the humours was accelerated, as well by an irritation of the fibres in the inflamed part, as of those throughout the whole body; and therefore every thing which can remove this irritation by being applied to the inflamed part, will restrain the impetus of the blood. But this irritation there arises, because the sides of the vessels are distracted by the blood urging behind the obstructions; and therefore every thing which can remove the obstructions, and give a free passage to the hesitating blood, into the open vessels, may remove this irritation. But such a passage may be procured to the blood two ways, either by so relaxing the obstructed vessels, that the impervious particles may pass through the extremities into the veins; or else by contracting the vessels in such a manner by things which cool, repel, and astringe, as to drive back the obstructing matter from the impervious ends of the vessels towards their larger bases, or into a larger part of those vessels. This last method was frequently used for the cure of inflammations by the antient physicians, when any part of the body was suddenly inflamed, without any apparent cause preceding, in which case they derived the cause of the disorder from an afflux of humours: And Galenⁿ, treating on this disorder, observes, that the methodical sect of physicians, and their followers asserted, that all inflammations were to be treated with laxatives, because they judged the disorder to proceed from an astriction. For it is to be observed, that this sect of physicians derived all disorders either from a stricture, or a relaxation of the solids only, in which doctrine they had afterwards many followers. But a little afterwards Galen adds, that both reason and experience teach, that after due evacuations the inflamed part is to be treated with such remedies as have a power of repelling the influent humours, and at the same time of evacuating those

ⁿ Method. Medend. ad Glaucon. Lib. II. cap. 2. Charter. Tom. X. pag. 370.

which are already contained in the affected part, and such also as can restore the tone or strength to the affected parts. For these purposes he recommends the *sempervivum*, *malicorium*, *rhus*, &c. in which there is manifestly a power of cooling and astringing. And in the following chapter of the same book, he says, that it will not be improper to apply such things as moisten and warm, to those inflammations which arise from other causes, but which do not proceed suddenly from such an afflux.

From what has been said therefore here, and in the commentary on § 390, where we treated of the effects following from the application of things actually or potentially cold to an inflamed part, it appears that coolers are serviceable with astringents and repellents only at some particular times; and that there is some caution required in their application, since if they do not prove serviceable, they may be very injurious. In the slighter inflammations they are often very serviceable, if applied in the beginning; and thus I have frequently seen incipient inflammations of the eyes cured only by the application of cold water. But when the disorder is inveterate, and the obstructing matter as it were (to use the expression of Galen, cited in § 390.) wedged into the vessels, it will not then suffer itself to be easily repelled; whence the vessels being rather contracted in their capacities by these remedies, and their humours coagulated, the disorder will be increased: and therefore in such a case it will be more proper to apply laxatives and aperients, which open the vessels, and loosen the obstructing matter. It is therefore the business of a prudent physician to vary and chuse his remedies according to particular circumstances.

It likewise seems of service in this case to take in the use of anodynes, or those medicines which ease pain. But these, as we observed in the commentary on § 202. act in a threefold manner; either by removing the cause of the pain, or by so disposing the

part in pain to which they are applied, that it becomes less affected by the painful cause; or lastly by removing the sense of pain, while the cause of it remains in the injured part. All the remedies therefore before mentioned will be anodynes, inasmuch as they remove the causes of pain, either by relaxing and opening the obstructed vessels, or by repelling the impervious matter from the narrower towards the larger part of the vessels; or which so dispose the affected part, that it is less injured by these causes. But besides these we have also a licence to use those remedies which remove the sense of pain in the part to which they are applied, provided those means are at the same time not neglected, which are capable of removing the causes of the pain. Hence the leaves of *hyosciamus*, *cynoglossæ*, &c. may be added to fomentations to be applied to the inflamed parts: for the effects of violent pain are (as we observed at § 226.) fever, heat, thirst, dryness, &c. all which are injurious to the inflamed parts, and as many of these disorders arise only from the sense of the pain, § 229. numb. 2. it is very evident that much good may be therefore expected from the use of those remedies which obtund the sense of pain.

S E C T. CCCXCVII.

THE injury itself, which is offered to the vessels, is likewise removed by the same means (396): for those which have been relaxed by too great a distraction will recover their former figure by the natural contractile force of the fibres, and their powers and nutrition will return.

The injury offered to the obstructed vessels arose from their distention by the impulse of the vital humours urging upon the obstructed part; and as every thing enumerated in the preceding aphorism tends either

ther to diminish or to turn off the impulse of the blood, it is very evident, that the injury may be removed by the same means. For so long as there are any hopes of obtaining a resolution, the continuity of the vessels is not yet dissolved, even though they are very much distracted, so that when the obstruction is resolved, the distracted fibres gradually recover their former dimensions, and all the disorder, which then remains, is a weakness of the fibres from their having suffered too great a distraction, (see § 25. numb. 3.) which is cured by removing the distracting causes, (§ 28. numb. 5.) and by restoring the lost strength of the vessels and viscera by suitable aliments. Now the more firm and elastic the vessels are, which have been distended by an inflammation, the sooner do they return to their former shape or dimensions; and on the contrary more time is required to restore the strength of the vessels in proportion as the inflammation is seated in a lesser series of them. Perhaps one may from hence derive the reason of several appearances, which remain a long time after the cure of inflammatory diseases of the encephalon by resolution: for it sometimes happens after a frenzy or a delirium in acute fevers, the small-pox, &c. that a considerable weakness remains, or a notable disturbance of all or some of the functions, which depend upon the encephalon, continues even after these diseases have been cured. If then the cure of them is attempted by blisters, purges, sudorifics, and the like evacuants, or powerful movers of the blood, every thing becomes worse, whereas by committing them to nature, those maladies in time disappear of themselves. The same thing is also confirmed by that most diligent observer of nature in the most abstruse diseases, Sydenham^a: for he remarks in a continual epidemic fever, which suddenly affected the head with a phrenzy, that after general evacuations made by bleeding and purging, a coma was sometimes left behind,

^a *Schedula Morit. de no. æ febris ingressu*, pag. 661.

which yet disappeared in time, provided the patient arose from his bed daily, and was not molested with violent remedies. For in these cases the equable motion of the humours, through the encephalon, seems to remain disturbed, till the vessels, too much weakened by distention, have recovered their former strength.

S E C T. CCCXCVIII.

THE obstructing matter will be reduced to a state of fluidity, if it be attenuated and diluted:

- I. By restoring the elastic vibrations of the vessels, by diminishing the distended humours, by plentiful bleeding and purging; by adding a stimulus to the fibres, by means of some thin aromatic liquor drank very warm; by fomentations, frictions, cuppings, and scarifications.

The third thing required in the cure of an inflammation by resolution, was to add and preserve a fluid state to the obstructing matter, (see § 395.) We therefore now come to treat of the methods and remedies for obtaining these ends, and first concerning those, by which the impervious matter is rendered so fluid, as to pass freely through the narrow extremities of the vessels. But this may be obtained two ways, either by diluting, as when the combined particles of the blood are separated by the interposition of water; or else by attenuating the matter, by the attrition of the vessels, with frictions and such remedies, as by the figure and rigidity of their particles may be capable of dividing the concremented parts. Also diluents and attenuators may be so combined as to produce greater effects by their conjunct powers.

I. Our blood naturally tends to concretion by rest, and this the more as the person is stronger; a continual motion is therefore necessary to alter the situation of the particles of the blood, and prevent their concretion; and it is by this same motion, that those parts are to be dissolved, which have once begun to concreate. When a person faints away, the blood stagnates in the large venous receptacles about the heart, and especially a large quantity is collected in the venous sinus and right auricle of the heart, and betwixt the lungs, where it begins immediately to be disposed to concretion; but if such a person is revived by the asperision of cold water, soon after a violent palpitation of the heart follows, and the viscid blood, which began almost to form a polypous concretion, will stagnate in the small extremities of the pulmonary artery; but upon the contraction of that artery, these fleecy concretions will be repelled, and thus will they return backward and forward, till they are at length attenuated and dissolved by the attrition from the sides of the vessel, and thereupon all the anguish ceases, and the blood has again its free course from the right ventricle through the narrow extremities of the pulmonary artery. The same effect may be expected, if the inflamed vessels are restored to their elastic vibrations, with which they before moved: for if we consider the causes by which our blood is moved in the vessels, it will appear that its motion must be performed even in the inflamed vessels, which will be first distended and then contracted again alternately. For when the heart contracts, it expels all the blood contained in its cavities into the arteries, which are already full, and which being flexible will be therefore dilated at the instant when the heart is in its contraction, after which the arteries will again contract to their former diameter by the elasticity and re-action of their muscular fibres, by which the blood contained in their cavities will be propelled forward; for the valves, placed at the entrance

trance of the aorta, prevent the blood from returning back towards the heart, and therefore it is derived through the arteries into the veins; if now we conceive an obstacle to be lodged in the cavity of an artery, so as to prevent the free course of its blood, that artery may be dilated by the impulse of the blood received from the force of the heart; but that artery cannot contract itself again the moment after it has been dilated, because the passage of its contained blood into the veins is obstructed, and the return of it is also prevented by the impulse of the blood urging behind; such an artery will therefore remain full and distended, but without motion, because the elasticity and force of its coats are not sufficient to remove the resistances. But how can we here restore the vibration of such an artery? it may be done barely by diminishing the quantity of the distending humour; but the obstructed end of the artery denies a passage into the vein, whence there is no other method remaining, but to diminish the quantity and force of the vital fluids to such a degree, that the natural contraction of the artery may be sufficient to prevail, and by that means repel the contained blood towards the basis of the artery. In that case the obstructing matter, being no longer pressed by the fluids urging behind, will pass by the contraction of the artery towards the basis of that vessel, unless it was so impacted in the narrow extremities, as to be quite immovable, and again the moment after, it will be propelled to its former situation in the narrow extremities, from whence an attenuation and division of the concremented particles may be reasonably expected. But that the concremented blood may thus dissolve into lesser particles, so as to be capable of passing through the narrow extremities of the arteries, has been demonstrated to the eye, in the experiment of Leeuwenhoeck, which we mentioned in the commentary on § 232. numb. 1. But in what manner the quantity and impetus of the distending fluids may be diminished

ed by bleeding and purging, has been declared before at numb. 2 and 3, under the preceding aphorism. But how much may be done towards a restitution of the oscillatory motion of the vessels, too much distended with fluids, is evident in plethoric patients, in whom the pulse of the artery is often scarce perceptible, when the plethora has acquired its utmost extent: but when the too great quantity of fluids is diminished by a plentiful bleeding, the pulse soon after rises, and all the functions are restored which were before oppressed.

By a stimulus added to the fibres by means of a thin aromatic liquor drank very warm.] The celebrated Baglivi, in a treatise which he has wrote, *De fibra motrice & morbosa*, has demonstrated, that there is a propensity to irritation in the solid parts of our body, by which their motions may be surprizingly disturbed by the irritation of stimuli, whether by increasing their natural motion, which they used to perform according to the laws of health, or else by disturbing it. It appears from the most certain experiments that stimuli produce this effect in the larger parts of the body. The ingested aliments are conveyed by degrees through the stomach, and all the convolutions of the intestines, till they arrive at the end of the intestinum rectum, and being in this long course drained of their more soluble parts, are at length discharged out of the body: but if the intestines are irritated by a stimulating purge, the ingested aliments will then be hurried through the bowels in a short space of time, with a considerable disturbance from an increase of the peristaltic motion. When acrid poisons corrode the internal surface of the intestines, they often cause them to contract so violently, as to be quite shut up in all those places where the poison touches, whence the elastic air being intercepted, enormous tumours of the abdomen have then been observed to follow. Even this irritability is so strongly inherent in many parts of the body, that they retain it after death, and exert
a mo-

a motion thereby when all the other parts are dead. The observation of Lord Bacon, mentioned in the commentary to § 1. informs us, that the heart of a man, who was exenterated, being thrown into the fire, leaped up to a considerable height, and continued its motion for the space of seven or eight minutes. When Peyerus opened the thorax and abdomen of a cat, when she was stiff and dead of an abortion, upon blowing into the receptacle of the chyle, he was surprized that the air passing to the heart occasioned first its auricles, and then the whole heart to vibrate for several hours. When the same anatomist happened to try the like experiment in human bodies, he found it had the same success, yet so that the motion of the heart was more easily recalled in some than in others: and sometimes he not only inflated air, which ought to be warm, but he also found it necessary to use an external warmth. He found by experiments that the hearts of those who had been hanged easily recovered their motion, and retained it for a more considerable time ^a. From all which it is apparent, that the application even of a slight stimulus to the fibres, viscera, and vessels, may excite them to greater motions. When the most healthy person has taken too large a quantity of salt, spices, or wine, the heart and arteries will be irritated by those stimuli to more frequent contractions, and produce a fever. When therefore the obstructed vessels have been a long time considerably distended by the impulse of the vital humours urging behind, their fibres are often so much distracted, that they lose their force, and do not sufficiently re-act upon their contained fluid. So soon therefore as the quantity and impetus of the distending blood has been diminished by bleeding and purging, it will be proper to exhibit such remedies, as by mixing with the blood, and passing through the arteries, may irritate their fibres with a gentle stimulus, so as to contract with a great-

^a Peyer. Paterg. Anatom. pag. 199.

er force, and by that means break or divide the obstructing particles small enough to pass easily through the extremities of the vessels, whence the inflammation will be cured by a resolution. But to answer this intention may serve, the milder sort of spices drank by the way of infusion in a large quantity of water, such as the ligna fantalorum, sassâfras, the five opening roots, &c. either infused or gently boiled, which can never be prejudicial in such a case. Such a form of medicine may be seen in the materia medica corresponding to this aphorism.

But while these remedies are taken plentifully, it will be proper to determine their action towards the affected parts, by fomenting, friction, cupping, and scarification; concerning the use of all which we treated in the commentary on § 134. But frictions are useful in this case, as they perfectly imitate and supply the action of the vessels by contraction and relaxation upon their contained fluids. But it is very evident that the frictions are here required to be but gentle, and that they ought never to be used to inflamed parts, till the pain and tension have been lessened or removed by evacuating and lessening the impulse of the blood.

2. By diluting the impacted matter, by drinking thin and watery liquors warm.

After a large quantity of the humours have been evacuated, and the vessels restored to their vibrations, nothing will be more conducive to cure an inflammation by resolution, than to fill the vessels with such a liquor as may very easily pervade all the smaller vessels. But such a fluid is water; and the most subtile parts of our humours, which come under our senses, resemble water almost in every respect; from whence it is evident, that water may pass through even the smallest vessels of the body. This fluid therefore drank warm is one of the chief remedies in all inflammatory

matory diseases ; for being brought by the laws of the circulation to those parts where the obstructions are formed, it will there insinuate and dilute, and be intimately mixed with the obstructing matter by the action of the vessels ; so that by interposing itself betwixt the obstructing particles, it will separate them from each other, which we call dilution. But what power water has in removing obstructions by diluting and attenuating, has been declared in the commentary to § 134 and 135. It is to be also observed, that water serves for a vehicle to all the other remedies which are capable of attenuating and dissolving the inflammatory concretions : and therefore all thin drinks in which water is predominant, are fit for the same purpose. Such are the whey of milk, milk and water, mild small beer, decoctions of barley, oats &c. and the infusions of coffee and tea.

3. By using attenuants, resolvents, and such things as are opposite to the nature of the obstructing matter, applied as well externally as internally in the form of decoction, bath, fomentation, vapour, cataplasm, emplaster, or ointment.

Although water can dissolve many concretes, such as all salts, things saponaceous, mucous, and gellatinous ; yet there are many things which water alone is not capable of dissolving. For this reason such remedies are mixt with water, as are known to possess a dissolving power ; and of these such are to be chosen as are opposite to the nature of the obstructed matter. But the obstructing matter in this case is the red blood, or a thinner impervious humour joined with it, stagnating in their proper vessels, or wedged into other smaller vessels by an error of place : at the same time there is also a greater motion and heat, which incline our humours very much to a state of putrefaction.

See

See § 84. numb. 4 and 5. and therefore the attenuators of the inflammatory concrete, ought at the same time to be very averse to putrefaction. We are acquainted with several remedies of this nature, in which there is not only a great power of attenuating and dissolving, but also of restraining putrefaction. Honey is one thing which possesses these qualities in a high degree, and which was therefore very frequently used in all inflammatory disorders; for by an immoderate or too long an use of this juice, the whole mass of blood may be so dissolved, as to be evacuated from the bowels under the form of water; and it also has the power of preserving or confecting all parts of vegetables from any manner of corruption. Even Herodotus^b tells us, that the Babylonians buried in honey. Sugar, which is at present so much in use, is endowed with the like efficacy: to these add the recent juices of garden fruits, the roots of succory, goat-beard, vipers grass, &c. all which may be used with success in the form of a thin decoction. Among the saline attenuants, nitre is preferable to the rest, because they are either alkaline, (See § 135. numb. 2.) and therefore dispose our humours more to putrefaction, or else they so increase the impetus of the arterial blood, by their stimulus, as to be not easily overcome by the action of the vessels. Various forms of pleasant medicines may be made with these ingredients for internal use; and it will be at the same time useful to apply the like medicines externally to the inflamed part, either in the form of a bath, fomentation, vapours, or cataplasm. But the external application of these remedies seems to be not only useful, inasmuch as the water saturated with the medicinal particles insinuates itself through the bibulous veins of the skin, and mixing with the blood, are by the laws of circulation carried throughout every part of the body, or else they may be determined more to the inflamed part, by deriving with attractives or pro-

^b Lib. I. pag. 80.

pulives (§ 134.) But the like remedies also act, inasmuch as being diluted with water, they insinuate into and through the arteries themselves, and by that means apply their force immediately to the obstructing matter; for that part of the artery which is beyond the obstruction remains empty, and is not urged by the impulse of the blood from the heart; and all the branches of such an artery, which arise beyond the obstruction, will be likewise empty: from whence that force by which very small tubes attract liquors into their cavities, will cause the fluid medicine applied to enter those branches. If therefore the obstructing particles are plied on all sides by attenuation, as well externally as internally, and if the elastic vibrations of the vessels are likewise restored at the same time, it is evident that the obstructing matter will be in a manner dissolved, provided there is but the least prospect of a mild resolution. But the plaisters and ointments which are applied to the inflamed part for this intention, ought not to be too adhesive, nor to have any considerable acrimony, because then they will rather increase the disorder. (See § 376.) Such of these are therefore to be chosen, which only adhere gently to the skin, and confine the thin exhaling vapours, so as to retain the parts affected as it were in a vapourous bath of its own, and by relaxing the bibulous veins to suffer the particles of the applied remedies to enter more easily.

S E C T. CCCXCIX.

TH E humours are rendered mild or unacid by watery drinks, a smooth diet, with mild or balsamic medicines, which dilute and obtund, or by such as naturally oppose the particular species of offending acrimony.

It was said before in § 386. that a mild or smooth disposition of the humours was necessary, in order to procure a resolution of an inflammation; and therefore it is not barely sufficient to render the obstructing matter fluid, unless the mildness is also preserved, or that particular species of acrimony corrected which attends. Water, and all watery liquors are more especially useful for this purpose: for nothing is milder than pure water, by which the most violent acrimony of any kind may be so diluted as to be no longer offensive. Even the most concentrated oil of vitriol, which in a moment destroys the part to which it is applied after the manner of actual fire, may be so weakened by a large quantity of water, as that it may be safely taken into the stomach. Now whenever there is an acrimony in the blood, the thirst which it occasions directs the patient to drink a large quantity of water, or some other thin liquor, until it is evacuated or washed out of the blood either by urine or sweat. The truth of this is experienced even in the most healthy people, who have eaten too much salted flesh or the like at their dinner. Besides this, the drinking of thin watery liquors also satisfies the rest of the curative indications, of which we treated under the preceding aphorism. The diet which will be most conducive to the same purpose, is to be composed of emollient pot-herbs, and soft pulse, such as barley, oats, wheat, rice, &c. with milk. Hippocrates nourished his patients in these acute diseases with nothing but a drink of barley, as is evident from his book, *De victu in morbis acutis*. The best remedies in this case are those composed of emollients, and things which are gently viscid or mucilaginous, such as marsh mallows, common mallows, mullen and the like in decoctions, with emulsions of oily and farinaceous seeds, the expressed oils themselves of those seeds, and every thing which so obtunds and sheaths acrimony, as to prevent it from doing any injury. But as these oils very soon become rancid, especially in hot weather,

ther, or by the heat of the stomach, therefore emulsions are often preferable, in which there is the same obtunding virtue of the oil, and that without any danger of its degenerating into a rancid acrimony. But if there is an acrid cacochymia before the inflammation arose, or if the like acrimony is observed in the juices after the inflammation is produced, then it will be convenient to use those things which are known to be specifically opposite to the apparent acrimony: thus absorbents are to be used in the acid species of acrimony, and also in the alkaline, but in a putrid species of acrimony acids are proper, &c.

S E C T. CCCC.

- A** Repulsion of the matter is procured.
1. By a large evacuation of the arterial and venal blood by phlebotomy.
 2. By relaxing the fibres.
 3. By artificial frictions.

It was said in § 395, where we enumerated the general curative indications to be observed for the cure of an inflammation, by dispersion or a resolution, that if the obstructed matter could not be rendered so fluid as to pass through the narrow extremities of the arteries, that there then remained but one method of cure; namely by repelling the matters from the smaller extremities into the larger vessels, where they might be taken up with the common circulation, and rendered pervious through those vessels which they ought naturally to pass. This method may take place in every kind of inflammation, but more especially in that kind which arises from the larger particles of the blood mistaking their course. That is, when the orifices of the smaller vessels are so dilated as to take in larger particles than can pass through their small extremities. For instance if in such a

case a red globule is repelled back out of the serous artery into which it entered, it will return into the sanguiferous artery through whose ultimate extremity it may easily pass into the vein, by which the inflammation will be resolved or terminated. But in order to repel the matter in this manner, it is necessary either to remove or very much diminish the impulse of the vital humours, urging upon the back of the obstruction; and at the same time the obstructed vessels are to be so relaxed, that they may easily permit the impacted matter to return back, and lastly a motion is to be communicated to the impervious particles, which may carry them back towards the larger part of the obstructed vessel; but each of these are accomplished by the means proposed in the three following numbers.

1. Concerning this you may consult what has been said in the commentary on § 141. numb. 1.

2. For the obstructing matter being wedged into a narrower part of the vessel, if the fibres of that vessel are rigid, the matter will be held so fast as to be immovable: It will be therefore proper in such a case to relax the fibres, when the impetus of the fluids urging behind, has been first diminished, otherwise the obstructed particles will be thrust further into the relaxed vessels, which is repugnant to the indication of repelling; for here we are not to attempt a propulsion of the matter through the relaxed vessels. But in what manner, and by what remedies, the fibres of the human body may be relaxed, has been declared in § 35, 36, and 54.

3. See what has been said concerning the use of frictions for this intention, in the commentary on § 141. numb. 2.

S E C T. CCCC I.

FROM hence we may ^{be} able to understand what that so much desirable resolution is, by which a compleat cure is performed without any crisis (386.) in all inflammatory diseases, whether external or internal.

In whatever part of the body the inflammation is seated, it always retains the same definite, or precise nature; namely an obstruction of the arterial vessels, with a violent impulse of the vital humours urging on the back of the obstructions. What is it therefore to resolve an inflammation? the answer is, that it consists in so attenuating and dividing the obstructing particles, which hesitate in some arteries, or by so relaxing the obstructed vessels, as to give the humours a free passage through them, which were before impervious; or even sometimes by repelling those particles back into the larger vessels. It is evident enough, that this method of curing an inflammation is of all the best and safest, because it restores the parts to their healthy functions, without offering any further damage to them. But it is not always in the power of a physician to cure an inflammation thus by resolution; the means required for performing which, have been mentioned in § 386.

Which makes a compleat cure.] A resolution only can be properly called a compleat cure of an inflammation, which it removes without inducing any other disorder: whereas the other ways of terminating an inflammation cannot be said to make a compleat cure, since they introduce an abscess or a scirrhus, even though they remove the inflammation; for, in this case, there is another disorder introduced, which will require its particular cure, before the parts can be restored to their healthy state. But when an inflammation

mation terminates in a gangrene, or a sphacelus, it does not then conduce to a cure, but the death of the parts.

Without a crisis.] What is properly meant by a crisis in diseases, and in what manner this word is used in various senses among the ancient and modern physicians, we shall have a better opportunity of explaining hereafter, when we come to treat more professedly on that subject in the history of fevers. It will be sufficient for us here to observe, that an inflammation is said to be cured without a crisis, when the morbid matter, namely the impervious humours hesitating in the arteries, is so disposed by the remaining vis vitæ, and the applied remedies, that it is again rendered capable of passing through its vessels agreeable to the laws of health: but when the same matter is removed from the narrow extremities of the obstructed vessels, and yet has not those conditions, which are required for it to flow through the vessels with the healthy humours, without injuring the functions, it is then either evacuated from the body, or else deposited upon some particular part, and then the inflammation is said to be cured by crisis, and the evacuation and deposition of the matter is termed critical. For example, when a red globule has entered a serous artery by an error of place, and an inflammation thence follows; if, that red globule be either repelled back from the serous into the sanguiferous artery, or else dissolved into the six serous globules of which it is composed, according to Leeuwenhoeck, that inflammation will be cured without a crisis, because the morbid matter is so disposed as to pass freely through all the vessels, which it ought to pervade in a state of health. But if the extremity of the obstructed vessel is thrust off together with its impervious matter, by a moderate impulse of mild humours urging behind, the obstruction will be thus removed; but then the humours will be extravasated from the dissolution of the continuity of the vessel,

and the separated end of the obstructed vessel with its impervious matter, being no longer obedient to the laws of circulation, is therefore to be considered as a foreign body which requires to be discharged: so that the tender solids which are thus separated mixing with the extravasated humours, are by the heat of the body changed into matter, formed by a mild incipient putrefaction, which matter will therefore require to be evacuated, as it can never be reduced to the state of our healthy juices. And in this manner also an inflammation is cured but by means of a crisis; because the morbid matter is first changed by the remaining vis vitæ, and then separated and discharged from the body. From thence you may plainly perceive the difference between the cure of an inflammation, which is made by a resolution, and that which is made by a crisis: and this doctrine will also appear agreeable to the general axiom which Galen^a delivers concerning the various events of diseases, viz. *Magni siquidem morbi judicantur omnino: quicumque autem parvi, solvuntur solum*; "That great diseases are always attended with a crisis, but those which are slight are only resolved." For a slight inflammation may be dispersed, when a violent one terminates either in a suppuration or a gangrene.

Of ABSCESSSES.

S E C T. CCCCII.

IF these means (395 to 401.) are used too late, not at all, or without success, the inflammation then goes on to suppuration (387.) which may be known by the signs there (387.) mentioned, and the indications will be

^a De Crisibus. Lib. III. cap. 4. Charter. Tom. VIII. pag. 433.

1. To hasten the maturation of the crude matters into one smooth humour.
2. To mollify the same and the parts adjacent.
3. To draw the matter outwards.
4. To procure a discharge to the concocted matter.
5. To mundify or clean the parts.
6. To compleat the cure, as in other wounds.

An abscess, termed also *apostasis* and *apostema*, was used in various senses by the ancient physicians. For Hippocrates^a uses this term to denote the change of one disease into another, when he says, *Ex aliis febribus & morbis abscessus in quartanas fiebant*: "Some fevers and diseases become quartans by abscess." He also used the term abscess to signify that endeavour of nature by which she separated any offensive matter from the blood, either evacuating it from the body, or else depositing the same upon some particular part: and hence the ancient physicians distinguished two kinds of abscesses; namely those by efflux, and such as were made by deposition upon some part^b. Thus, for instance, in a peripneumony, the morbid matter was observed by them to discharge itself by spitting, a bilious diarrhoea, or a copious and thick sediment in the urine; in which cases the abscess was said to be by efflux: but when no such excretion was observed, and there were nevertheless apparent signs that the patient would survive, then Hippocrates^c observes, that an abscess is to be expected either about the ears, or towards the lower parts of the body, by a deposition of the morbid matter in some place. And in this sense abscesses are defined by Galen^d, *Af-*

^a Epidem. 1. Textu 21. Charter. Tom. IX. pag. 44.

^b Galen. Comment. 2. in Lib. I. Epidem. Hipp. Text. 44. Charter. Tom. IX. pag. 55.

^c Prognostic. Charter. Tom. VIII. pag. 655. & in Coac. n. 395.

^d Method. Med. ad Glaucon. Lib. II. cap. IX. Charter. Tom. X. pag. 382.

fectiones illas, in quibus ab invicem secedunt, quæ prius se mutuo tangebant, corpora. Spatium igitur in medio vacuum fieri necesse est, quod materiam aliquam flatulentam aut humidam, aut ex utraque mistam, continebit. Mutantur autem in abscessum & inflammationes quædam, & Erysipelatosi Phlegmonodesque tumores non pauci, &c.

“ To be those disorders in which the parts of the
 “ body before cohering, recede from each other.
 “ There must be therefore of necessity a void space
 “ made betwixt the parts, which space will contain
 “ either a moisture, or flatus, or a composition of
 “ them both. But many tumours of the phlegmo-
 “ node and erysipelatous kind, and some inflamma-
 “ tions are changed into an abscess,” &c. For when
 the obstructed ends of the inflamed vessels are separated by the impulse of the humours acting behind, they mix with the extravasated juices, and by the warmth of the parts change into matter, which by removing the contiguous parts, makes itself a passage: but as a true phlegmon is almost constantly seated in the panniculus adiposus only, that membrane by its easy yielding, may be sometimes distended to a very great degree by the matter which it contains. But that such a preternatural cavity is formed by the confined matter, after the phlegmon is suppurated, and that it did not before exist, is evident, inasmuch as by incising the inflamed part with a lancet before any matter is formed, the whole tumour appears solid, and discharges only blood or a thin ichor: but when such a part is wounded after a suppuration is formed, and the matter discharged, there appears a manifest cavity, made by the receding of the parts which were before contiguous.

There is no room to doubt, that the method of curing an inflammation by resolution is of all the best; but as this is frequently not in the power of the physician or surgeon, then a suppuration only remains, since it is evident enough, that the other methods of terminating an inflammation; namely, in a gangrene
 or

or schirrhous, are much worse. If therefore it shall appear from the signs mentioned in § 387. that the inflammation is of such a nature, that a resolution cannot be expected, or if there were some hopes at the beginning, but by a neglect or a perverse treatment continued for many days, the obstructions are confirmed in such a manner, that the matter is quite irresolvable, then the curative indications direct speedily to promote a suppuration, to remove all those parts of the solids and fluids, which have been so changed, as to be no longer obedient to the laws of the circulation; and when this is performed, the lost substance may be regenerated, and the parts united which were separated from their natural cohesion. But this is what we are to consider in the following numbers of this section.

I. So long as the material cause of a disease continues of such a nature, as to either continue or increase the distemper, it is termed crude; but when it has been so altered by the remaining vis vitæ, its own natural disposition, or the use of proper remedies, so as to be less remote from the laws of health, and to produce less disturbance in the functions of the body, it is then said to be concocted; and that state of the disease, in which its material cause is thus altered, so as to be less offensive, is called the time of maturation or concoction. This crudity may therefore take place both in the solid and fluid parts, and so may likewise its alteration or maturation; but in a plegmon all the obstructing matter is called crude, which cannot be resolved, and also every vessel which is so obstructed that it cannot be opened. In order to restore health therefore, such obstructed vessels with their impervious contained matter, ought to be separated from the rest of the living and pervious vessels, and by mixing afterwards with the extravasated humours, to be formed into laudable matter. So long therefore as the ends of the impervious vessels remain unseparated, the vis vitæ urging on the back of the
obstruc-

obstructions, will increase all the inflammatory symptoms, (See § 381, 382.); but when this separation is once made, as the humours will then have a free passage through the broken ends of the vessels, it is sufficiently evident, that all those symptoms must be very much diminished. Crudity is therefore known by the intensity or increase of all the symptoms; but maturation is discovered by the remission of them. This is very well expressed by Celsus^e, where he treats of abscesses: *Crudum est autem, in quo major quasi venarum motus est, & gravitas, & ardor, & distentio, & dolor, & rubor, & durities; & si major abscessus est, horror, atque etiam febricula permanet: penitusque condita suppuratione pro his, quæ alioqui cutis ostendit, punctiones sunt. Ubi ista se remiserunt, jamque is locus prurit, & aut sublividus, aut subalbidus est, matura suppuratio est;* “ But the matter is crude when the
 “ arteries have a greater motion accompanied with a
 “ heaviness, burning, distention, pain, redness, and
 “ hardness of the parts; and if the abscess is large, a
 “ shivering and slight fever continue: but when the
 “ suppuration is finished, instead of these there are
 “ pricking pains which otherwise point out the part
 “ of the skin affected; and when those pains grow
 “ more remis, and the part itches and looks bluish,
 “ or whitish, the suppuration is then mature.”

2. The hardness or resistance of inflamed parts arise from the great compactness of the solids and fluids. (See § 382. numb. 4.) and so long as they continue, the disorder may be justly termed crude. But maturation requires a separation of the ends of the obstructed vessels from the other sound parts; and therefore the more those vessels are mollified and in a manner dissolved, the sooner, and with less pain will they be separated. But if a violent phlegmon has invaded a part, we generally observe that all the circumference of the tumour remains hard, even though the middle of the part affected turns soft; and there-

^e Lib. V. cap. 28. n. 11. p. 327.

fore the adjacent parts of the tumour are to be fomented with emollients, as Celsus observes, when he says, *Si qua circa duriora sunt, ad ea mollienda, vel malva contrita, vel fœni græci linive semen ex passo coctum superdandum est*; “ If there are any adjacent parts harder than the rest, they are to be mollified by the application of bruised mallows, or the seed of fœnigræc, or linseed boiled in sack.”

3. If matter should be formed by suppuration in the inflamed part, which is seated in the external surface of the body under the skin, the skin is then usually elevated into a tumour, and this more especially if the part is fomented with emollient and relaxing medicines. But if the inflammation is more deeply seated, there will be more danger, lest the matter should make itself sinuses in the adipose membrane, or if it is seated in some of the internal parts, it may corrupt the viscera with a putrid tabes. So soon therefore as it appears from the signs mentioned in § 387. that the inflammation tends to suppuration, then all the endeavours of art are to be used to draw the matter to some external part. Celsus^s, in treating of the cure of a pleurisy, recommends bleeding for a severe pain which is recent, but when that remedy is used too late, or proves fruitless, he says, that then, *Confugiendum est ad cucurbitulas, ante summa cute incisa. Recte etiam sinapi ex aceto super pectus imponitur, donec ulcera pustulasque excitet; Et tum medicamentum, quod humorem illuc citet, &c.* “ Recourse is to be had to cupping-glasses before the skin is incised. It is also right to apply mustard and vinegar upon the breast, till it has excited blisters or sores, and then to use a medicine which may stir up the humour, and direct it thither, &c.” In a peripneumony, when the disorder is increased to the highest, he observes^h; *Prodesse etiam impositum super pectus salem bene contritum, cum cerato mistum: quia*

^s Lib. V. cap. 28. n. 11. pag. 328.
pag. 209, 210.

^h Lib. IV. cap. 6.

leviter cutem erodit, eoque impetum materiæ, qua pulmo vexatur, evocat. Utile etiam aliquod malagma est ex his, quæ materiam trahunt: “That it may be also serviceable to apply salt finely ground and mixed with cerate to the breast, because it gently corrodes the skin, and by that means calls off the violence of the matter which injures the lungs. It is also useful to apply a cataplasm of such things as draw matter.” If now the matter formed can be conveniently drawn outwards, the event of the inflammation need not be so much feared; for patients often die after a suppuration from a pleurisy, while the ulcer full of matter does by its tumor pressing inward obstruct the lungs, and produce suffocation, or else by breaking, deposits its matter into the cavity of the thorax; whence an empyema, consumption, and death. But if an abscess formed about the ribs, should point outwards, and cause a tumour in the external skin, a happy cure generally succeeds by opening the tumour, and discharging the matter. Therefore, for these reasons, the antient physicians applied irritating substances to stimulate the external parts, or else they fomented the parts with emollient cataplasms and fomentations, to derive the impetus of the disease outwards.

4. When the ends of the obstructed vessels, together with their impervious blood mix with the adjacent humours, and by the warmth and stagnation in a close place form a white fat and uniform liquor, it is then said to be concocted matter; but by what signs, one may know that such a matter is present, we shall explain hereafter at § 405. But when this matter is contained a long time in a close and warm place, it becomes gradually thinner and more acrimonious; and as there are small absorbing veins which open throughout the whole surface of the cavity in which the matter is confined, it will be drank up by those veins, and conveyed into the mass of blood, whence it will occasion a purulent cachochymy, whence a hectic fever

fever and consumption follow. Besides this the matter rendered more acrimonious will corrode the whole surface of the part in which it is contained, and being at the same time attenuated, it may very easily make itself new passages in the panniculus adiposus; from whence sinuses and fistulæ of the worst kind often follow, barely for want of procuring a timely discharge to the concocted matter. And from hence again the difference betwixt curing an inflammation by resolution and suppuration is sufficiently apparent. For when the inflammation is resolved, the matter of the disease is so scattered by the remaining vis vitæ, and proper remedies, that it becomes very much like the healthy humours with which it flows, through all the vessels without injury to any of the functions; and therefore no evacuation is required. But when a separation is made of those solids and fluids, which the inflammation has destroyed, they then turn into laudable matter; which yet is a liquor quite foreign to the nature of our humours, and by mixing with them disturbs all the functions, and excites a fever, until it is either evacuated from the body, or else separated from the blood, and translated to, or deposited in some particular part of the body; from whence again it must be evacuated, in order to perform a cure. It is therefore evident, that an evacuation of the concocted matter is necessary, and that in due time, since it always becomes acrimonious by long standing. But what ill consequences may follow when matter is too long confined in an abscess, we are taught by practical observations. A maid of forty years old had a suppuration of the left parotid, so that on the fourteenth day of the disease there was an abscess as large as one's fist. But as no fever attended in the beginning of the disorder, and she every day followed her domestic business, yet as the confined matter was not timely discharged, it produced a fever, attended with the worst symptoms, such as faintings, vomitings, watchings, &c. of which she expired a few days after.

after. The abscess was indeed broke several days before death, but little or no matter was discharged ^h. In a child of three months old there arose an abscess about the right shoulder; but as the parents would not allow it to be opened, the tumour naturally subsided of its self, but the absorbed matter being translated to the genital parts, it there produced a fatal gangrene ⁱ. There are many observations of the like nature, which demonstrate how dangerous it is to leave concocted matter confined for too long a time in a vomica or abscess.

5. So long as the part suppurated remains close, it is termed vomica clausa or an abscess, but when a discharge of the matter has been procured either by art or nature, the disorder is then termed a vomica aperta or an ulcer. But the whole internal surface of the cavity, in which the matter was contained, is more or less infected by the matter, especially when that has been confined a long time, and rendered more acrimonious by heat. It is not therefore possible either to procure a consolidation or union of the parts, nor a restitution of the lost substance, before the whole surface of the cavity is first reduced to the state of a clean wound. Therefore the half dead extremities of the vessels, and half corrupted parts of the panniculus adiposus must be first separated, and all the rest performed in the manner we directed in the history of wounds, § 206 to 209. Hence Hippocrates tells us, *Ulcerata non purgata coire nolunt, etiamsi adducantur; neque etiam sponte coalescunt. Ulcera etiam, quorum circumpositæ partes inflammantur, coire non possunt, quamdiu non cessaverit inflammatio. Neque, si ambientes ulcus partes denigratæ fuerint, aut sanguis putrescens, aut varix sanguinis influxum suppeditans adfuerit, talia coire possunt, nisi circumstantes ulceris partes sanas*

^h Hildan. Observ. Chirurg. Centur. I. Observ. 30. pag. 39.

ⁱ Ibid. Observ. 81. pag. 59.

effeceris: “ that foul ulcers will not unite, even
 “ though they are retained together; nor will they
 “ conjoin of their own accord. Ulcers likewise, whose
 “ circumjacent parts are inflamed, cannot unite, as
 “ long as the inflammation continues. Nor can such
 “ ulcers be healed or conjoined, if the circumjacent
 “ parts are black, beset with putrid blood or accom-
 “ panied with a varix, which bleeds, all which will
 “ prevent the union, unless you reduce the circum-
 “ jacent parts of the ulcer to their healthy state^k.”

6. After the ulcer has been depurated, it acquires the nature of a clean wound; and then a regeneration of the lost substance, and an union of the parts separated, may be procured.

S E C T. CCCCIII.

THE maturation is performed by applying such things as,

Increase the motion of the humours in the part, by fomenting, stimulating, and warming materials, which either warm actually or virtually; and the use of the like remedies in the whole body, may be serviceable by exciting a fever.

The maturation of all crude inflammatory matter into concocted pus, must be performed by the remaining vis vitæ; for when the strength of life is defective or languid, no matter is formed: and therefore *Hippocrates*^l, reckons the appearance of dryness in an ulcer, either before or in a disease, among the signs of death. It is also from a weakness of the vital powers, that the spitting is diminished, or even frequently quite ceases in the latter end of a pulmo-

^k Hippocrat. de Ulcer. cap. 4. Charter. Tom. XII. pag. 132.

^l In Prognosticis Sentent. 22. Charter. Tom. VIII. pag. 605.

nary consumption. But the *vis vitæ* is estimated or measured by the force of the circulating humours through the vessels; and as the obstructed ends of the vessels with their impervious contained matter are to be separated by the impulse of the humours acting behind, it is evident that this separation will be sooner performed, if the strength and swiftness of the blood's motion is increased through the vessels of the part to be suppurated; for then the circulating fluid will strike more frequently and strongly in a given time against the obstructed ends of the vessels, and separate them sooner from their cohesion. Hence it is that we enumerated an increased motion of the humours, among those conditions (§ 387.) which cause an inflammation to tend to suppuration. But it is to be observed, that too great a velocity of the humours suddenly excites a rupture in the vessels, and does not procure a gradual separation of their ends; whence a gangrene follows instead of a mild suppuration, as was observed before at § 388. A just medium is therefore here required, so as to keep up the motion of the humours greater than in health; but not to let them move too violently. But the heat of the inflamed part, when it is seated in the surface of the body, or a more or less fever when it is seated internally, will demonstrate whether the motion of the humours ought to be increased or diminished. Therefore the motion of the humours, if defective, is to be excited by the application of topical remedies to the affected part, and by the use of internal medicines. And as we observed in the comment to § 371. that an inflammation is accompanied with a fever either in the whole or in the particular part of the body, so it will be also necessary to increase the motion of the blood, either in the inflamed part only, when that can be done; or else throughout the whole body, by exciting a slight fever. Thus we see in consumptive patients that there is a slight fever always invades the patient every day, while the matter is forming; but

which fever diminishes when the formed matter is spit up. Therefore Hippocrates has pronounced in the place we before cited, in the comment on § 387. *circa puris generationes dolores & febres magis accidere quam pure facto*: “that the pains and fever are more intense, about the time when matter is forming, than after it is compleatly formed.” In the materia medica corresponding to this section, the aromatic gums are recommended to us, such as ammoniacum, galbanum, opopanax, &c. in all which there is a moderate stimulus, and at the same time a sufficient degree of tenacity, by which they adhere to the part where they are applied, and thus by confining the very subtle exhaling vapours, they keep the part as it were in a vaporous bath of it's own, and at the same time their aromatic stimulus insinuates into the relaxed vessels; and hence it is that the application of these remedies, has often such happy effects, when a scirrhus is feared from too weak a motion of the humours. But all these things which excite a greater motion in the affected part, by such a mild stimulus, have also the virtue of warming or heating; because a greater heat arises from an increased motion of the humours through their vessels, as was demonstrated in the commentary on § 382. numb. 6. Those things are also very serviceable, which are actually warm, provided they are not applied so hot, as to dissipate the more fluid parts of the humours, and convert the remaining parts into the hardness of a scirrhus. Therefore the best of all, in this case, will be to apply warmth with moisture, namely, to foment the part to be suppurated by the use of cataplasms and fomentations, secured with hot woollen cloths or the like, to retain the parts in a gentle and constant heat. For as Hippocrates^m says, *calidum suppuratorium, non in omni ulcere, maximum securitatis signum: cutem emollit, extenuat, dolorem sedat, &c.* “a suppurating heat is not a sign of the greatest success in every

^m Hippoc. Aphor. 22. Sect. V. Charter. Tom. IX. pag. 207.

“ ulcer, though it mollifies and extenuates the skin, “ abates the pain, &c.” but why Hippocrates says, not in every wound or ulcer, is explained by Galen, in his commentaries to this aphorism; namely, because hot things are hurtful to putrid and running ulcers, by increasing their putrefaction, and attracting their flux of humours.

2. The heat and motion excited in the part, are there confined by preventing too great an exhalation, and dissipation of it, by constipating or glutinous substances, and by diminishing the too great acrimony.

The inflamed part is always hotter than is usual in health (see § 382. numb. 6.) and as all the symptoms of the inflammation increase, when it tends to suppuration (see § 387.) therefore the heat will be increased while the heat is forming. But by an increase of heat, the more fluid parts of our humours are dissipated, as will be evident from the commentaries on § 689; therefore it will be extremely serviceable to apply such things as continually moisten as well as warm the affected part, to restore those thin vapours which are continually dissipated by the increased heat. Those remedies will be therefore best which contain a large quantity of water, and which do not easily suffer it to exhale again, and such are all glutinous substances, which with water are capable of forming a soft paste, such as all meals, and especially that of linseed, which is capable of imbibing a large quantity of water. Of these and such like substances may be formed cataplasms, which are very emollient, of which there are various forms given in the materia medica, corresponding to this aphorism. If these are involved on all sides about the part to be suppurated, and suffered to continue there day and night, especially if care be taken to keep them warm; it is usual for any irresolvable inflammation to suppurate and be converted
into

into laudable matter; but as all these remedies mollify as well as moisten and relax the solid parts, they very much diminish the pain, attending a suppuration often in no small degree (see § 228. numb. 1.) and they mitigate all acrimony, by sheathing and obtunding; therefore they are likewise serviceable inasmuch as they conduce to that mild disposition of the humours, which is required towards a suppuration, as was said in the commentary on § 317. but as there is here no small danger of a putrefaction in the humours which stagnate in the obstructed vessels (see § 84. numb. 4, and 5.) promoted by the increased heat and quicker motion of the humours, through those adjacent vessels which remain pervious, therefore such substances are to be chose, which are soon altered into a disposition opposite to that of putrefaction, by the heat of the part by which they are applied; that is to say, which easily turn sour. Hence it is, that surgeons add rye flour, vinegar, sorrel, and the like substances, which soon turn acid, in the composition of their maturing cataplasms: and to these, they usually add also fresh butter, linseed oil, or the like, very soft fat substances, partly because they prevent too great a dissipation of the moisture, from the cutaneous pores; and partly, because, by this means, the cataplasm is prevented from drying and growing hard too soon.

3. By moderating the motion of all the vital humours, and their temperature, so that they may neither be sluggish nor excited too much.

This rule is of the greatest moment in the practice of physic, as well in the cure of internal as of external diseases. An increased motion of the humours, causes an inflammation to tend to suppuration (see § 387.) but too violent a motion of them, causes a sudden destruction of the very tender and minute vessels, and produces a gangrene (see § 388). But in the resolution of an inflammation the motion of the humours is

but moderate, (see § 386.) So long therefore as there is hopes of a resolution, the physician or surgeon boldly diminishes the impetus of the vital humours, by the remedies mentioned at § 396. in order to prevent any further injury from being offered to the inflamed vessels: but when the signs denote that it is impossible to resolve the inflammation, then it is required to give the humours a greater motion than they had naturally in a state of health, in order to separate the obstructed ends of the vessels, and convert them with the extravasated humours into laudable matter; from whence it is evident, that in such a case it may be often prejudicial to use those things which weaken the force of the circulation. It is therefore here necessary so to moderate the course of the humours through the vessels, as to make them pass with a greater heat and motion than is usual in health, either by the exhibition of medicines internally, or by the application of topical remedies to the affected part, where the suppuration is to be made; but yet these remedies ought not to be so violent, as to destroy all the vital influx of the humours, by suddenly bursting the vessels, that is, so as to produce a gangrene. That the humours flow thus moderately, may be known, if the heat of the inflamed part does not much exceed the heat of the blood in health; if a pain attends, but not violent; if a moderate pulsation is perceived, together with a tumour, redness, and the other symptoms of inflammation gradually increasing: and by the appearance of these signs in the affected part, we are informed whether the vital motion of the humours ought to be increased or diminished. But when the inflammation is so great as to disturb the whole body, then the intensity of the fever, thirst and dryness of the tongue, easily demonstrate what ought to be done to moderate their violence. There is therefore no universal suppurating medicine; but different remedies are required, according as the motion of the humours is to be either increased

creased or diminished. To promote a suppuration in the body of a young person of a warm habit, it will be proper to apply a cataplasm of oatmeal, milk and fresh butter; but in old people of a melancholic or cold habit, it will be proper to add roasted onions, galbanum, gum ammoniacum and the like moderate stimulators, that by gently increasing the motion of the humours a suppuration may the better succeed in the inflamed part, and prevent a scirrhus; which last is too often the consequence of an inflammation, that is too languid in some glandular part. The same doctrine is also true in regard to internal inflammations. Thus, in the beginning of a pleurisy, a very bold use of the lancet continued till the patient faints, often removes the disease; but when the physician, being called too late, perceives that it is no longer possible to procure a resolution, it then remains to concoct or digest the morbid matter, and discharge it either by spitting, urine, or some other evacuation; or else, finally, to convert it into an abscess. And at that time bleeding, and other evacuations which too much weaken the vital powers, are always prejudicial; since, in such a case, a moderate fever is required to mature the crude matter of the inflammation.

4. The inflamed part is not to be opened till all is suppurated, which remains irresolvable. For by these means laudable matter is made in the part.

It frequently happens in the larger abscesses, that the center of the suppurating part appears soft and yielding to the fingers, while in the mean time, the greater part of the tumour which is inflamed, continues hard in all its circumference. But as many bad consequences may follow, by confining the matter too long in a close place, after it has been formed, as we shall explain more at large in the commentary

on § 406. therefore surgeons usually make haste to open such tumours, even when they perceive but a small fluctuation. But all the disorders which have been observed to follow too long a confinement of the matter, proceed either from the acrimony or putrefaction, which it, by that means, acquires; and as the quantity of it gradually increases, it eats new passages into the panniculus adiposus, and produces sinuofities and fistulous ulcers; or else a purulent cacochymy is produced in the blood from an attenuation and absorption of the matter taken up by the bibulous veins; or lastly, the more fluid parts of the matter being dissipated, the rest thickens and produces scirrhus tumours, especially in the glandular parts. But so long as the part remains not opened, and no access is given to the air, the matter does not so soon degenerate into a putrid state; but being confined within its cavity by the hard circumference of the tumour on all sides, it cannot easily burrow into the panniculus adiposus: nor can there be any great danger of the matter's being absorbed, since the arterial vessels which are distended with an irrefolvable inflammatory matter, compress the adjacent veins. Besides this, the matter lodged in an abscess, which is but thus half matured, makes one of the best remedies, by which all the adjacent, or as yet hard and crude matter may be dissolved or consumed. * Hippocrates has a sentence of the like nature, which we mentioned in the comment on § 323. *Necesse est, carnes contusas & laceratas in pus versas tabescere:* "Contused and lacerated flesh, must necessarily be dissolved and changed into matter." Thus it was also observed in the commentary on § 158. numb 7. that the matter formed in a wound, dissolved the lacerated fibres and extremities of the inflamed vessels, with their obstructing matter. It is therefore evident, how useful it must be not to open the suppurating part, till all

* De Vulner. Capit. cap. 14. Charter. Tom. XII. pag. 121.

the crude inflammatory matter is brought to maturation: for thus we imitate nature, who most happily accomplishes the suppuration of what ought to be changed into matter, while the integuments of the part remain whole. In like manner, after the parts have been divided by a recent wound, and the hæmorrhage is over, a bloody crust is then formed upon the surface of the wound, which is cleansed by a mild suppuration under that crust. And hence Hippocrates^b every where observing the dictates of nature, lays it down as a medical axiom, *Quæcumque concoqui oportet, occludi convenit; contraria vero exsiccare & aperire*: “That whatever is required to be concocted, ought to be shut up from the air: but when the intention is contrary, we are to open and dry up the parts.”

If now every thing is put in practice, which we have enumerated in the four preceding numbers, then laudable matter will be formed in the part: but what the conditions of good and laudable matter are, has been said in the commentaries on § 387.

S E C T. CCCCIV.

UNless the inflammatory matter is thus altered or matured, it will be both dangerous and unsuccessful to make an opening of the abscess.

For if the tumour is opened before the matter of an inflammation is brought to maturity, mere blood is then discharged instead of matter, as we said in the commentary on § 382. numb. 2. or, if the matter is but in part suppurated, by discharging that, the rest will be indurated, and cannot so soon and so easily be brought to maturation. Besides this, when tumours are laid open by incision in their crude state, they always excite more severe pain, and there is greater

^b Epidem. Lib. VI. Textu 34. Charter. Tom. IX. pag. 416.

danger of injuring the subjacent parts, by perforating the skin. For in a mature abscess, the confined matter elevates the skin from the subjacent parts; and therefore an opening may be more easily made by the lancet, when its sharp point enters into a cavity full of matter; whence there will be no danger of injuring the vessels, or muscular fibres. Hence Celsus^a, in treating of abscesses, which are formed in nervous parts, says, *Sed cætera etiam subcruda aperiri possunt; inter nervos ultima expectanda maturitas est, quæ cutem extenuet, eique pus jungat, quo propius reperiatur:* “But though in other tumours which are in some
 “measure crude, an opening may be made; yet a-
 “mong the nerves or tendons, the last degree of ma-
 “turity is to be waited for, whereby the skin may be
 “extenuated, and come into contact with the matter,
 “as it points more outward.” The same will be also true in those places, in which there are large blood-vessels seated, as in the groins and armpits, in which there are inflammatory tumours frequently formed, tending afterwards to suppuration. For no prudent person will open such an abscess before the maturation is completed, because the large vessels, or their considerable branches may be easily injured, to the hazard of the patient’s life, when they are opened too soon. But how much the cure will be retarded, and the pains augmented, if an abscess is opened while crude, is evident from the observations of the best surgeons. For a very painful and inflammatory tumour was formed after a fever in the axilla of a certain nobleman; the surgeon who attended, was urged by more prudent advice to open the tumour with a lancet, as soon as he perceived a slight fluctuation, which was performed with no small pain to the patient, who was not at all relieved by the small discharge of matter, but on the contrary, the fever and inflammation were increased. The disorder was afterwards cured by a long continued use of emollient ca-

^a A. Corn. Cels. Medic. Lib. VII. c. 2. pag. 409.

taplafms, though it might have been cured in a few days time, if the tumour had not been injudiciously opened before its maturation was compleated. The same thing is also proved by many more instances, alledged by the celebrated le Motte^b, whom we have so frequently quoted. Thus I have sometimes seen venereal buboes, which being opened too soon for fear of a confirmed lues, have occasioned the greatest difficulties, and often proved incurable for several months; the surgeons being obliged to consume them by caustics, when the same thing might have been prevented with certainty in a few days time, by letting the matter continue longer confined in the parts. But it is to be observed, that the outward margin in abscesses has often some degree of hardness, while the rest is perfectly brought to maturity: now when such tumours break of their own accord, and discharge all their matter, those hard remains are usually melted down and discharged in a few days time. It will not be therefore prejudicial to open such tumours, as have the greatest part of them suppurated.

S E C T. CCCC.V.

THAT the matter is formed and fit to be discharged, is known by the softness of the part, a fluctuation and whiteness of the pressed tumour, a remission of the pain, heat, redness, tension, pulsation, and fever, instead of which a dull or heavy pain succeeds, and the tumour forms a prominent point.

Since therefore it is dangerous to open a tumour, which tends to suppuration, before it is perfectly matured; and as many bad consequences may also follow, if the formed matter is too long confined and

^b Traité complet de Chirurgie, Tom. I. pag. 211, &c.

shut up, as we shall declare under the following aphorism; therefore it is necessary to give a diligent attention to those signs which inform us, that the matter is so far advanced and collected in an abscess, that it may be successfully discharged by opening. But these signs are deduced from the alteration of those appearances which happen in the affected part, while the irrefolvable matter is suppurated, even until a perfect maturation is completed.

A softness of the part.] It was demonstrated in the commentary on § 382. numb. 4, that a considerable hardness in a phlegmon proceeded from the solids and fluids being violently compacted together, because the inspissated blood stagnated in the obstructed vessels, which were as yet intire. But when the distended vessels are burst open, and their humours extravasated in the suppuration of a phlegmon, the tender solids are then torn off, ground together, and dissolved in the humours, so as to form matter, (see § 387.) whereupon a softness consequently follows, by a conversion of the inflammatory matter which was before hard and crude, into a yielding fluid under the entire skin. For there may be a considerable hardness in bodies, which are even composed for the most part of fluids, provided the juices are contained in distinct vessels, and not accumulated together into one part; of which we have an instance in apples, pears, turnips, &c. for though these fruits have an incredible quantity of juice, yet they often appear very hard; but by bruising, or by dressing with fire, they turn into a soft pulp; because then the elastic air concealed in those fruits, being rarified by heat, breaks their vessels, and extravasates their humours, insomuch that the hardest apple is thus softened to such a degree in a quarter of an hour's time, that it runs or spreads about. The same thing also happens, when the continuity of the vessels in such fruits is dissolved by putrefaction.

Fluctuation of the pressed tumour.] That surgeons may be assured whether or no the inflamed part is uniformly suppurated, they usually apply their fingers to each side of the tumour, pressing it gently first to one side, and then to the other: and if then they perceive a fluctuation or undulating motion of the contained humour upon the side opposite to that which they press'd, they then know that the whole compass of the tumour is sufficiently maturated. But when no such fluctuation can be perceived, even tho' the tumour appears soft on all sides; then there may be some crude inflammatory matter in its middle, which may hinder the motion impressed on one side of the humour, from being communicated to the opposite side. But that there are such abscesses which are in a manner divided in the middle by a crude matter there seated, while there is a perfect maturation in their circumference, we are taught by chirurgical observation; and even Hippocrates^a has observed the same, when he says, *Tubercula foras protuberantia, in acumen sublata & fastigiata, & æquabiliter commaturationescentia, neque in ambitu dura, & deorsum tendentia, neque bifida, meliora (sunt.) Contrari mala, & quæ plurimum contraria, pessima:* " Tumours which project outwards, and form a point after the pain is abated, and which are not hard in their circumference, but uniformly maturated and tending downwards without a division in their middle, these are of the better kind: but the contrary sort are bad, and those which are the most contrary are the worst." Also Galen^b, in his commentaries on this text, observes, *In bifidis medium non sine vitio inveniri, crudum (ἀνεκπύητον) nempe & durum:* " That in tumours which are thus divided, the middle is observed to have one fault, namely, a part that is crude and hard." It is indeed true, that a mature

^a Epidem. Lib. VI. Textu 13. Charter. Tom. IX. pag. 375.

^b Ibid. pag. 376.

abscess has this fluctuation in common with aneurisms, and some vesicular tumours which contain juices; but yet an abscess is very well distinguished from these, inasmuch as it follows from an inflammation preceding. But it is sufficiently evident, that this fluctuation cannot be easily perceived by pressing upon the tumour, unless it is protuberant; for when an abscess is lodged deeply in the panniculus adiposus among the muscles, it cannot be easily discovered by this sign.

Whiteness.] It was demonstrated in the commentary on § 382. numb. 1. and 2, that redness accompanies an inflammation, because the obstructed vessels are distended with red blood, together with the panniculus adiposus; and therefore when the impacted inflammatory matter, together with the ends of the obstructed vessels, pass into white and uniform matter, then the causes of the increased redness will be removed. Besides this, while the matter is derived outwards, with the application of emollient cataplasms or fomentations, they extenuate the skin; which therefore becomes wasted, and acquires a white colour. For when the exhaling vapours of the skin are confined by the application of a plaister, they moisten the skin so much, that in a few days time, it appears white; and by degrees the subjacent white matter appears through the extenuated skin, which conduces to render it of that colour. From hence therefore the reason is evident, why a white colour is justly enumerated among the signs of a mature abscess. Celsus^c, in treating of abscesses, takes notice, *Et, quod de subito durius non est, melius est: Et quod, quamvis rubet, coloris tamen in album mutati est: quæ signa jam pure oriente nascuntur: tumor enim ruborque multo ante incipiunt*: “ That the tumour which does not immediately appear harder than usual, is of the better
 “ sort, and so is that which having looked red, has
 “ yet altered its colour to a white, which affords the

^c Lib. V. cap. 28. n^o. 11. pag. 326.

“ proper

“ proper signs of forming matter : for the tumour and
 “ redness begin much earlier.”

Remission of the pain, heat, redness, tension, pulsation, and fever.] All these signs of inflammation are produced by the impulse of the blood received from the remaining *vis vitæ*, by which it urges against the ends of the obstructed vessels, with an increased force and velocity (see § 381.); and the reason of all these we gave in the commentaries on § 382. Therefore after the ends of the obstructed arteries have been separated by a suppuration, the cause of these symptoms will be removed, or at least be very much diminished; and therefore Hippocrates justly observes, that the pain and fever are greater about the time of the matter's forming, that when it is already formed, (see the passage cited from him in the commentary on § 387.) But it must be observed, that sometimes the most acute pain continues, even though the part to be suppurated has acquired a perfect maturation, and this because the confined matter daily increasing, gradually distends the superincumbent skin; but this pain immediately ceases, when the abscess either breaks spontaneously, or is opened with a lancet. Therefore Celsus^d, having enumerated the signs by which the crudity of an abscess is discovered, (see the commentary on § 402. numb. 1.) immediately subjoins, *Ubi ista se remiserunt, jamque is locus prurit, & aut sublividus aut subalbidus est, matura suppuratio est*: “ When these
 “ signs are diminished, and the part begins to itch,
 “ or appear blueish or whitish, the suppuration is then
 “ mature.” For it must be observed, that though the skin generally appears white when the abscess is mature, yet the cutaneous vessels are sometimes so much compressed by the distending matter, that by the destruction of the vital influx and efflux of the humours through them, the skin acquires a livid colour, and becomes gangrenous. Almost the same signs of a maturation of an abscess are related by

^d Lib. V. cap. 28. n^o. 11. pag. 327.

Ægineta^c; for he says, after enumerating the signs which denote that the inflammation tends to suppuration, *Consummato abscessu, plurima (horum) minuntur, puncturæ autem pruriginosæ fiunt, & torpor sentitur, & tumor in apicem acutum elevatur, tangenti lenis & cedens, & superficies circa apicem abraditur* (ἀποστέλαι): “After the abscess is formed, many of these symptoms are diminished, a pricking or an itching follows, a torpidity is felt, and the tumour is elevated into a sharp point, soft and yielding to the touch, and the surface about the point of the tumour is gradually abraded.” He well remarks the manner in which the skin is gradually eroded by the confined matter extending to the point of the abscess.

The tumour forms a prominent point.] When a phlegmon tends to suppuration and maturity, there is almost constantly a softness and fluctuation perceived in the middle, even though the circumference remains as yet hard; but as it is usual to apply emollient cataplasms to promote the suppuration, therefore the relaxed integuments usually give way in their center to the matter which is gradually formed, by which they are extended above the equable surface of the tumour; since in the other parts of the tumour, its greater hardness prevents its easy extension. For this reason therefore the tumour will be formed with a point outwards, in which place the integuments being gradually weakened and distended, the abscess will there break of its own accord, or may be most safely opened by the lancet.

A dull or heavy pain.] It was said a little before, that the pain increased as long as the inflammation lasted in the suppurating parts: for the ends of the obstructed vessels are to be gradually broke off, and therefore when the nervous fibres dispersed thro’ the coats of the vessels, are the nearest to breaking, the pain will be the most acute, (see § 221.) but will cease when they have been quite broke asunder. But

^c Lib. IV. cap. 18. pag. 64.

then there will be matter formed, from the juices extravasated in some preternatural cavity which they make, or else collected in some natural cavity dilated; and by the weight of the matter distending the parts, there will be a dull or heavy pain, as if caused by a weight. For though a healthy person does not perceive the weight of his own body, yet when the humours are extravasated and collected, he will immediately perceive a heaviness or pain of weariness. When the blood is collected in the panniculus adiposus, after a rupture of the vessels under the entire skin, from some violent contusion, the patient immediately complains of an unusual heaviness, or uneasiness in the part, (see § 320. numb. 2.) When the serum accumulated in the dropsy called *anasarca* distends the legs, the patient draws them after him as if they were made of lead. But it is very evident, that this sense of heaviness can take place only when the suppuration is large; it being one of the principal signs of a latent abscess from an internal disease, if after an acute pain, the patient perceives the sense of an internal weight pressing upon the affected side, as will hereafter be made evident in the pleurisy, peripneumony, and the like diseases, when we come to treat of them particularly.

S E C T. CCCCVI.

IF now the matter be left a long time confined in the part, it becomes attenuated, putrified, augmented, and erodes or consumes the adjacent parts, by which with its quantity, weight, and motion, it creates sinuses and fistulæ of different kinds in different parts of the body, but the worst in or near the intestinum rectum. Or else the more thin juices of the matter being dissipated, the rest is indurated, and forms hard tumours,
more

more especially seated in glandular parts; or lastly, the matter being absorbed by the lymphatic veins, or else pressed into the mouths of the eroded blood-vessels, it then mixes with the blood, which it infects, and being collected in the viscera, consumes them with abscesses of the worst kind, disturbs their functions, and by that means produces an infinite number of diseases of the very worst kind.

After it has appeared from the signs mentioned under the preceding aphorism, that all the crude inflammatory matter is brought to maturity, and changed into a laudable matter, then that matter ought to be discharged as soon as possible: for when once the matter is arrived to its last perfection, being white, thick, smooth, uniform, and inodorous; from that time it begins gradually to degenerate, and is every day altered for the worse. For the matter is not contained in the vessels, nor is it any longer obedient to the laws of the circulation, but stagnates, and by the warmth of the parts, naturally inclines to a state of putrefaction. For the parts of animals putrefy, though confined in a close place, cut off from any communication with air, only they corrupt then more slowly. We also observe, that all our humours become thinner by putrefying matter; for though blood immediately congeals after it is taken from a vein, yet at length it entirely dissolves when it begins to putrefy. The cystic bile, which is always thicker in healthy quiescent animals, does yet become thin and fluid by putrefaction. Therefore when clean and laudable matter is too long confined in an abscess, it loses its unctuousity, and balsamic thickness, by which it almost resembles the cream of milk, and is changed into a thin ichor; but this great tenuity arising from putrefaction, is always accompanied with a greater acrimony, as we said in the commentaries on § 86: the
whole

whole internal surface therefore of the cavity, in which the attenuated and acrid matter is confined, will be continually macerated and corroded by the sharp ichor, the ends of the small vessels will be dissolved, and their extravasated humours will acquire the same kind of corruption; so that the sides of the containing cavity being continually eroded, the sinus of the abscess will be always increasing, and the quantity of matter will be enlarged, by the humours derived thither from the eroded vessels. There are innumerable and evident observations to be found in the most approved authors, which prove that the solid parts of the body may be consumed or corroded by the matter, which has been too long confined and rendered putrid. The lungs have been so much consumed after an empyema, that there were scarce any remains of that important viscus to be seen, as we read in Schenckius ^a. The same author also has an observation of the compact substance of the heart itself, and its pericardium dissolved or corroded by matter ^b. And most surgeons lament frequently, that the solid bones are corroded and rendered carious by corrupt matter in deep suppurations, *etc.* Hence the reason is evident why Hippocrates ^c pronounced that those empyematic patients might recover, in whom there is a discharge of white and pure matter, after the operation performed either by incision or cauterization; but that if the matter was discharged bloody, filthy, and ill smelling, they must perish. As ^d he also observes in an abscess of the liver, that the patient will perish if a foul matter is discharged when he makes water; for in that case the substance of the viscera being corroded by the matter, renders the case extremely dangerous.

^a Observat. Medic. Lib. II. pag. 251.

^b Ibid. p. 274.

^c Aphor. 44. Sect. 7. Charter. Tom. IX. pag. 315.

^d Ibid. Aphor. 45. Sect. 7. pag. 316.

Besides this, as an inflammation is the most frequently seated in the tunica adiposa, as we said before at § 374; therefore a suppuration arising from the inflammation, will be seated in the same part. But the very tender fabric of this membrane, may be very easily corroded by matter which is become acrimonious; even the matter may so distend this very easily dilatable membrane by its weight and bulk, that it may make itself new passages and sinuses of the worst kind. In the commentary on § 244. and 300. numb. 5. It was demonstrated, that the air entering the panniculus adiposus, sometimes produced a surprising emphysema or windy tumour, in which the whole body was in a manner buried; from whence it appears, that there is a ready passage from any one part of this membrane into all the rest of its extent. Thus I have seen, for want of discharging the matter which was formed by a suppuration of the parotide gland, that it has made itself a way downward, through the panniculus adiposus of the neck to the shoulder, arm, and even to the bending of the elbow: insomuch that the ligaments which connect the articulation of the elbow, were so corrupted, that it afterwards produced an incurable anchylosis. An abscess was formed after a deep inflammation, round the articulation of the femur; and as the matter concealed under the large muscles could not be evacuated, it descended and formed a sinuous ulcer, running thro' the whole length of the thigh and leg: whence the robust youth was destroyed by a purulent cacochymia, after suffering the most tedious afflictions, and trying all means to no purpose. If now we also consider, that the matter collected in the cellular membrane is attenuated by the warmth and stagnation, and that it often lies under strong muscles, it is very evident, that being pressed by the motion of those muscles, it may be propelled through all the adjacent parts, and by that means produce sinuses and fistulæ of the worst kind, more especially when the matter insinuates into

into the cellular membrane, which is interposed betwixt the muscles themselves. Now as the tunica adiposa is of a greater thickness, or as there are a greater number of strata of muscles lying over each other above the suppuration, so much the worse sinuses or burrows may be formed by the too long confined matter. And hence it is, that such troublesome fistulæ and sinuses are sometimes observed in the abdomen, by reason of the great quantity of fat there seated and interposed betwixt the several strata of the abdominal muscles, as we observed before in the commentary on § 307.

There is no part of the body in which there are worse fistulæ and sinuses formed by matter being too long confined, than about the intestinum rectum. For as the grossest fœces must pass through that intestine to be discharged, it was necessary that it should be capable of an easy dilatation every way; and therefore there is a large quantity of soft fat placed all round this intestine, into which the confined matter which has been too long retained in an abscess, may penetrate and form sinuses: for as Hippocrates^e observes, *Putrescens enim mollia depascitur, quum intestinum rectum humidum sit, et caro mollis, in qua pabulatur, donec tuberculum rumpatur, et infra versus intestinum rectum computrescat*: “The matter corrupting
“ eats away the soft parts, because the intestinum
“ rectum is moist, and its parts soft, in which the
“ abscess burrows, until the tumour breaks, and pu-
“ trefies downwards towards the intestinum rectum.” If now the rectum itself is also corroded, the matter may spread itself through the cellular membrane, and mucilaginous cryptæ, &c. of that intestine, so as to produce most tedious maladies, which are still much increased by the foulness of the intestinal fœces which are to pass this way. Hippocrates fearing these disorders, would not have a maturation of the tumour to

^e Hippocrat. de Fistulis, cap. 1. Charter. Tom. XII. pag. 141.

be waited for; but would have it opened as soon as possible, even though crude ^f.

Or by dissipation of the more thin juices, *etc.*] This sometimes happens to an abscess, though but seldom, and especially when it has been treated with very hot medicines without the addition of emollient and moistening ingredients. Thus it is customary with the women to expose a suppuration of their breast to the heat of a burning coal, to avoid having the abscess opened by the lancet of the surgeon. In that case the more thin juices being dissipated, the remainder is compacted into a scirrhus, which will be in danger of turning to a cancer as long as the patient lives; which change of it does but too often happen. The like hardness frequently remains after venereal buboes have been opened before their time of a complete maturation, or which have been treated with remedies too hot. The caution of Galen ^g is therefore here seasonable, which he gives in treating on the cure of a phlegmon or an erysipelas, when a scirrhus might be feared from those disorders; for he says: *Quod si quis vehementer trahentibus et discutientibus medicamentis vacuare tentet, nec iis, quæ humectent et calefaciant, molliat ac liquet; huic paucis primis diebus pulchre successisse curatio videbitur; illud vero, quod de affectu restabit, insanabile erit. Si quidem toto, quod in eo erat tenuium partium, discusso, quod reliquum est, velut lapidosa concretio linquetur.* “ But if any one attempts to evacuate with medicines “ which draw or discuss too violently, without adding “ those with moisten as well as warm, and mollify as “ well as dissolve, he will imagine the cure goes on “ very well for the first few days, but yet that which “ is left of the disorder, will prove incurable. For “ all that matter being discussed, which consisted of “ thin particles, the remainder is left like a stony concrete.”

^f Ibid. cap. 2. pag. 142.

^g Galen. Method. Med. Lib. XIV. cap. 4. Charter. Tom. X. pag. 322.

Or lastly in the sanguiferous or lymphatic veins, *etc.*] It was said before in the commentary on § 158. numb. 7. that matter was formed in wounds by an extravasation of the humours from the broken ends of the vessels, which were inspissated either by a dissipation or absorption of their more fluid parts by standing. For if a wound is cleansed every hour, we shall not find any matter but only a thin humour, which would become matter within the space of twelve hours. But the more fluid parts of the extravasated humours seem rather to be absorbed by the mouths of the veins, than to be dissipated externally; because laudable matter is not usually formed, unless the wound is well covered by some plaister or ointment, and we know that there are the mouths of the divided veins, as well as of the small arteries opening throughout the whole surface of the wound, which may drink up the contiguous juices by that power with which very small glass tubes attract liquors, and by transmitting them afterwards to the larger veins, those humours may at last mix with the blood. In the same manner likewise when matter has been too long confined in an abscess, it naturally becomes much thinner, and putting off its mild balsamic nature, it becomes acrimonious, and then being absorbed by the contiguous orifices of the veins, it infects the blood with a purulent cacochymy, whence a hectic fever and a consumption follow. But that matter confined in any cavity of the body, may be thus absorbed by the mouths of the veins, and mixed with the blood, we are taught by many observations. A certain nobleman was shot through the fore-arm with a bullet in the time of battle, by which the bones of the cubitus were fractured, whence a continual fever and many bad symptoms followed, and at the same time a large abscess invaded the wounded and adjacent parts. When the surgeons were about to open the abscess which they now thought mature, the patient was seized with a profuse diarrhoea, and immediately all the tumour of the limb subsided, a large quantity

of matter being visibly discharged in the patient's stools. And when afterwards there was more matter formed in the abscess, upon a return of the diarrhœa, that matter also disappeared, and in this manner was that dangerous wound cured. ^h Scultetus ⁱ tell us, that he saw a large quantity of matter voided with the urine, in a man who was wounded in the abdomen, by which all the symptoms were relieved. Galen ^k also observed an abscess of the lungs voided by urine, and one of the thorax discharged by stool. A vomica of the lungs attended with a distortion of the spine, has been observed ^l to be cured by a purulent dysentery continued for several days; and this notwithstanding the weakness and many bad symptoms, persuaded the most expert physicians, that there was no further hopes remaining; and the girl was not only in a manner snatched from the jaws of death by this flux, but also the distortion of the spine amended of itself. In the small-pox how often do we observe, that the absorbed matter excites a fever of the worst kind? and that afterwards the matter being deposited in different parts of the body, suddenly produces tumours, which being opened, discharge a true matter, and sometimes degenerate into ulcers of the worst kind. In short, there are an infinite number of observations given us by authors of the best credit, which demonstrate that matter being too long confined, may be absorbed by the veins and mixed with the blood, so as to be afterwards deposited in several other parts of the body: it is also evident from those observations, that the event of this translation is very doubtful and various, according to the nature of the particular parts, in which the matter is deposited from the blood. For though in the preceding cases, the matter was happily discharged by urine or stool, yet there was always great

^h Belloste Chirurg. d'Hopital. part. 3. chap. XV. pag. 264.

ⁱ Armament. Chirurg. Observ. 61. pag. 245.

^k De Locis Affectis, Lib. VI. cap. 4. Charter. Tom. VII. pag. 517.

^l Acad. des Sciences l'an 1731. Mem. pag. 724. &c.

danger of its corrupting some of the viscera, or of depraving the whole mass of blood with which it mixes, so as to produce incurable diseases. For the matter which is collected in an abscess, which is not opened, can scarcely be absorbed, until it is first attenuated, and rendered acrimonious, and when it afterwards flows with the blood through the vessels, it acquires a still greater acrimony, whence fevers of the worst kind, a corruption of the blood itself, and an infinite number of diseases follow. From hence we often observe in the small-pox, that when every thing is thought to be secure, a high phrenzy suddenly arises, by which the patient is soon taken off unexpectedly; namely, from an absorption of the matter, and a translation of it to the brain. Hippocrates^m relates the case of a patient, in which there seems to have been something of this nature. For he describes the patient as afflicted with an internal suppuration of the thorax, accompanied with a stertor, or weefing, which with the difficulty of respiration, seemed to indicate that a large quantity of matter was collected within. But, says he, *prope sexagesimum autem diem oculus sinister cum tumore excæcatus fuit, sine dolore: neque longe postea etiam dexter oculus, pupillæque admodum candidæ et siccæ fiebant, neque multo post hanc excæcationem mortuus est, non ultra septem dies, cum stertore et multa desipientia*; “about the sixtieth day the
“left eye was blinded with a tumour, but without
“pain: nor was it long after before the right eye and
“its pupilla, became very white and dry, and in a
“little time after this blindness, not more than seven
“days, the patient expired with a stertor and light
“headedness.” For it seems very probable that the absorbed matter was by an unhappy translation carried first to the eyes and then to the brain, by which it destroyed the patient. It is therefore evident, that different diseases will arise according to the particular na-

^m Epidem. Lib. VII. Ægrot. 30. Charter. Tom. IX. pag. 565.

ture of the viscera, upon which the matter is deposited; and as the same matter either compresses or corrodes the adjacent parts, which lie contiguous, it may either disturb or totally destroy their functions. From hence it is also evident, that the greatest prudence is required in conducting this matter; for if the abscess be opened before it is arrived to maturity, it may occasion many bad consequences, as was said in the commentary on § 404. but if a discharge is not procured to the formed matter, then also the most fatal consequences may attend. But the signs of a perfect maturation, with the treatment necessary to procure it, were described in the preceding aphorism.

It is from this absorption of the matter that those so frequently perish, who have received a large wound, which daily affords a large quantity of matter, as when an aneurism has been cut out, or a limb amputated, *etc.* For if in these cases the matter be frequently wiped off from the surface of the wound, where it is collected, the body will be deprived almost of all its nourishment, which will be that way discharged, so as to destroy the patient with a true marasmus; but if the matter is left longer upon the surface of the wound, by being absorbed, it will produce a purulent cacochymia, with all its consequent maladies, unless the matter is washed out from the blood with which it is mixed, by drinking large quantities of deterging vulnerary decoctions. But sometimes the patient's strength is so weak as not to be capable of bearing a large quantity of such decoctions, without being thrown by them into a dropsy, and in that case the event is almost constantly unhappy.

S E C T. CCCCVII.

THE integuments of the part suppurated, with such as are adjacent must be mollified, attenuated, and relaxed within and without, by the application of the same remedies (403.)

When an inflammation cannot be cured by a mild resolution, the best method that then remains, is to procure a suppuration, to obtain which, those curative indications are required, enumerated at § 402. and comprised there in six numbers. For in the first place the crude inflammatory matter is to be brought to a perfect maturation ; concerning which we are now to treat, as also concerning the signs, by which we may be assured, that the maturation is compleated ; and in the preceding aphorism, we enumerated those ill consequences which are to be feared, when a mature abscess full of laudable matter is not opened in time. The second curative indication was to mollify the part to be suppurated, with those adjacent, see § 402. numb. 2. concerning which we are to treat at present in this aphorism.

We observed that an inflammation is most frequently seated in the panniculus adiposus or cellular membrane, as it is sometimes called, (see § 374.) which membrane is covered externally with a thick skin and its cuticle, both which are to be cut through, or naturally divided, in order to make a way for the discharge of the matter, whence it readily appears, that it is in this case highly necessary to relax and mollify the integuments. But those remedies which were recommended in the commentary on § 403. for bringing the crude inflammatory matter to maturity, will also be sufficient for this purpose. For those glutinous substances recommended at numb. 2. of that aphorism, which stop up the pores, have also at the same time a
power

power to relax and mollify the solid parts. While therefore such cataplasms or fomentations are applied externally, to the part to be suppurated, the integuments are as it were macerated and dissolved without, while at the same time, the matter excited to action, produces the same effect within; all which is still further promoted by that heat which invades the suppurating part, (see § 403. numb. 1). Nothing more therefore seems to be necessary to accomplish this curative indication.

S E C T. CCCCVIII.

AL S O by these means (407.) the resistance of the integuments is diminished, while at the same time, the matter formed by the maturative remedies (403.) is either drawn or thrust outward.

The matter now formed, and confined in a close place, in which it is daily increased, being pressed by the adjacent parts, will by the laws of fluids tend that way where it meets with the least resistance. If now the integuments are so much weakened or relaxed by the application of the most emollient remedies, that they may very easily give way to the distending matter, that matter will elevate the integuments and tend outwards, without making itself any sinuous passages into the adipose membrane. All those remedies therefore which were recommended for maturing the crude matter of the inflammation, will also attract or give the formed matter a tendency outwards. For it was proved in the commentaries on § 134. that attractive remedies were such as diminished the resistance in any part, towards which the humours were to be derived.

S E C T. CCCCIX.

AND then things which are moderately acrid, emollient and oily, are to be mixed and applied together, that the dead integuments may be more easily opened and without pain.

A discharge is to be procured to the matter confined under the integuments, which therefore requires them to be divided, either by perforating with a lancet, or else by a spontaneous and gradual laceration made by the distending matter. But to effect this with the least pain, the most emollient and oily substances are to be applied, by which the integuments may be so extenuated, as to be almost destitute of sense, like a dead part. Therefore when an abscess is almost arrived to a state of maturity, and rises up to a sharp point, surgeons usually apply a pledgit spread with basilicon or some other very soft ointment, to mollify the integuments in the most protuberant part; for by thus relaxing the fibres, the pain is diminished, (see § 228. numb. 1.) which is generally severe enough in that prominent part of the tumour. Sometimes also there is a quantity of some moderately acrid substance mixed with the emollients, as yeast, Venice soap, honey, *etc.* which in some degree erode or destroy the macerated integuments, and occasion them to divide sooner. Thus washer-women who have been macerating their hands all day in strong soap-suds, have the skin of their fingers white and almost dead, insomuch that it frequently peels off. Forms of such like remedies as are here required may be seen in the *Materia Medica*, corresponding to this aphorism.

S E C T. CCCCX.

IN the next place the matter being discreetly pressed towards the rising part of the tumour, the scalpel or lancet is then to be entered into the lower part of the whitest, softest, and most prominent point of the abscess, until the discharge of matter demonstrates that the knife has entered sufficiently deep, which is then to be raised in an even manner so as to cut through the integuments with a longitudinal incision, or else by entering the point of the knife through the opposite part of the tumour, the middle of the integuments are to be cut through, avoiding at the same time the fibres and vessels: after this the abounding matter is to be gently pressed out, at several times successively, taking care not to offend the wound either by admitting the air, or by the use of tents.

When the whole circumference of the part appears sufficiently mollified, and all the signs denote that the maturation is completed, if then the integuments do not open of their own accord, a discharge of the matter is to be procured by art, to prevent it from inducing those consequences which we mentioned at § 406. But in glandular parts an abscess is to be left longer before it is opened than in other parts, because there is here greater danger of a scirrhous, if any part should be left behind, which has not yet been brought to a maturation. Hence Celsus^a in treating of the opening of abscesses observes, *si pus maturuit, in alis quidem et inguinibus raro secandum est: item ubicumque mediocris abscessus est: item quoties in summa cute, vel etiam carne vitium est, nisi festinare curandi imbecillitas*

^a A. Corn. Cels. Medic. Lib. XII. cap. 2. pag. 408, 409.

cogit. Satisque est cataplasmatibus efficere, ut per se pus aperiat, nam fere sine cicatrice potest esse is locus, qui expertus ferrum non est. “ If indeed the matter should
 “ come to maturity in the arm-pits or in the groins,
 “ it ought seldom to be discharged by incision: and
 “ the same is also to be universally observed when the
 “ abscess is but moderate, and when the disorder is
 “ seated either in the external skin or in the fat, unless
 “ the weakness of the patient, should require it to ex-
 “ pedite the cure. It is in these cases sufficient to ap-
 “ ply cataplasms, by which the matter may make its
 “ own way; for the part which has not suffered the
 “ action of the knife or cautery may remain with lit-
 “ tle or no scar after the cure.” From whence it ap-
 pears, that the spontaneous aperiſion of the abscesses is
 not only preferable when they are seated in glandular
 parts, but also when they are in danger of producing
 any deformity by a scar. But then a wound made by
 a lancet may be afterwards better healed, than if a
 larger portion of the skin was to be destroyed, or
 wasted by the contained matter. But why Celsus
 should observe that an unsightly scar often remains
 after an abscess has been opened by an instrument of
 iron, is very apparent from what follows in the same
 place: for when the matter is lodged very deep, he
 orders the abscess to be opened by an actual cautery;
 and otherwise when the skin is very much extenuated,
 he would have all that part of it cut out which covers
 the matter. He likewise extirpates the skin in the
 same manner when it looks pale; for then he says it
 will become dead and useleſs, and will be therefore
 more commodiously cut off.

To procure a discharge to the matter which is col-
 lected in a mature abscess, we must endeavour to per-
 form it with as little trouble to the patient, and with
 as little danger and injury to the adjacent parts, as we
 possibly can: for we are to divide no more than the
 common integuments, which are distended and elevat-
 ed by the matter confined beneath. Hence it is usual
 for

for surgeons to prefs very gently with their fingers upon the whole circumference of the suppurated tumour, in order to make the integuments recede as much as possible from the subjacent parts: and as some part of the tumour is generally raised to a point, as was said at § 405. therefore the scalpel is to be entered principally into that part as the integuments are there more extenuated, and being almost dead, they may be easily perforated almost without pain, especially if that point of the tumour has been before treated by the application of moderately acrid and fat substances, as we directed under the preceding aphorism. But to do this with the more advantage, the inferior or most depending part of the tumour is to be chose for the aperture, that the matter may be discharged by its own weight: but in this, attention must be also given to the posture which the part will require after the opening has been made. For as Celsus^b observes, *Danda (enim) opera, ut imus sinus exitum habeat; ne quis humor intus subsidat, qui proxima et adhuc sana rodendo sinuet;* “ for we must endeavour
 “ to let the sinus have an opening at its bottom, lest
 “ any humour should be confined within, and insinuate
 “ itself farther, by corroding the adjacent parts, which
 “ are as yet sound.” But if the point of the abscess is arrived at maturity in its upper part, and the integuments appear there softest and whitest, it will be best to make the opening in that part, rather than in one which is more depending, but has its skin as yet inflamed and very painful, so that it cannot be divided without frequently producing much trouble to the patient and the surgeon. For the opening being made, the matter may be entirely discharged from the abscess, and prevented from making any sinuous passages through the panniculus adiposus, by changing the situation of the part with a gentle compression, and a

^b Celsus *ibidem.*

judicious application of compresses and bandage, according to the nature of the part.

So soon as the knife has penetrated the integuments, it enters into the middle of the purulent matter, which then immediately discharges itself by the sides of the knife, more especially if the integuments were at the same time stretched by a gentle pressure upon the subjacent matter. But when there is a very large quantity of matter, it is best to enter the knife pretty deep, that the wound may be afterwards enlarged, by an even incision made in elevating its point. For the same reason likewise, when it may be safely performed, the knife is thrust from one side of the prominent part of the abscess to the other, and then by elevating it, the superincumbent integuments are divided at once to make the opening the larger, which can never be prejudicial. For unless the opening is made thus large, very great portions of the cellular membrane will be thrust out, almost in a gangrenous state, together with the matter, whence the aperture will be obstructed, and a new incision again required. Add to this, that when the matter is discharged, the integuments which were before distended, will be contracted into wrinkles, so as to very much diminish the opening which has been made, and therefore it may be taken almost for a general rule, always to make the incision as large as possible, in the opening of an abscess, provided it can be done without danger of injuring the subjacent parts. But when the matter is lodged immediately under the skin, it is very evident that then there will be no need to enter the knife to any considerable depth. But sometimes the greatest caution is necessary, when the matter is concealed in parts very remote from the skin; for it will be bad to make an incision upon an abscess without obtaining the discharge required, but it will be often more dangerous to enter the knife deeper into the part, than was at first thought necessary, and therefore in such difficult cases the skill and dexterity of the surgeon are more necessary and apparent.

For unless he is well acquainted with the situation of the parts from anatomy, he will be always trembling either with a vain fear, or else with a rash assurance he will despise the danger of which he is ignorant. For as an inflammation is seated most frequently in the panniculus adiposus, as we have several times observed before, and as that membrane insinuates itself betwixt all the muscles, it is evident that the matter may sometimes lie very deeply concealed without causing any apparent defect in the integuments. The signs of a deep inflammation having proceeded, and having been afterwards attended with the signs of a consequent suppuration, with a fluctuation of the matter upon pressing the part, will afford some light into those obscure places. A very remarkable case of this nature is related by the celebrated Le Motte^e. A woman was confined to her bed for nine months after a suppression of her lochia, being obliged to continue with her body inflected, in order to lessen the very acute pains; for she always continued in the same posture day and night, with her heels drawn up towards the nates, and her face bowed down to her knee. As the pain was seated chiefly in the middle of the hypogastric region, betwixt the navel and the pubes, therefore a more diligent examination was made in that part, by which the surgeon perceived a sort of undulation, though there was neither hardness nor tumour, nor any kind of change in the colour of the integuments. But by long experience, he determined from his knowledge in other diseases of the like nature, that there was here concealed a deep abscess which was the cause of all the maladies; and though he was opposed by four surgeons who had attended the unhappy woman before, yet he insisted upon making an opening in that part, which with great caution he performed, till he had penetrated into the cavity of the abdomen. But notwithstanding this opening was made,

^e *Traité complet de Chirurgie. Tom. I. pag. 280.*

no matter could be discharged even though the abdomen was compressed, the patient held her breath, and the posture of the body was altered. The excellent surgeon being astonished at his ill success, went away privately derided by the other surgeons, and candidly confesses that he did not sleep all the night. The next morning upon removing the apparatus which was applied the day before to the wound, he had the satisfaction to see a large quantity of matter discharged, though he could not understand where it lay concealed. The matter continued to discharge itself daily, for about the space of six weeks, and the woman by that time perfectly recovered of so desperate a disorder. She afterwards bore children, and was able to walk very well, only inclining a little towards the right-side, where the disorder had been seated. I remember to have seen a case of the like nature, when a surgeon opened a deep abscess in a woman's breast, which did not discharge so much as one drop of matter, although the scalpel had entered to the depth of above an inch; but yet a few hours after a large quantity of matter discharged itself spontaneously through the opening. From hence it is evident that the diagnosis in such a case ought not easily to be changed immediately; when after maturely considering all the circumstances, it is concluded that the part ought to be perforated or laid open; for although the point of the scalpel should not have penetrated into the cavity of the matter, yet the matter will be afterwards derived towards that part, as there will be there a less resistance.

Avoiding the fibres and vessels.] If the confined matter is lodged immediately under the skin, or if, as Celsus^d terms it, the matter is conjoined to the skin; it is evident enough that there can be no danger of injuring any considerable fibres or vessels as the matter elevates the skin from the subjacent parts; nor has it ever yet appeared that a true suppuration has succeed-

^d Lib. VII. cap. 2. pag. 409.

ed in the substance of a muscle, but that it is always lodged in the panniculus adiposus, for though Ægineta^e says, *quod abscessus sit corruptio et permutatio carniū aut carnosarum partium, veluti musculorum, venarum, arteriarum*; “that an abscess is the corruption, or alteration of the flesh or fleshy parts, as the muscles, veins, and arteries;” yet we are taught by daily observation, that after the panniculus adiposus has been consumed by large suppuration, or even gangrenes, yet the muscles have appeared extremely clean and intire. It is indeed true, that we sometimes observe extraordinary changes, not only in the tunica adiposa, but also in the substance of the muscles themselves; but then upon opening such a tumour there is not a discharge of matter, but a liquor of a different kind, whence it would seem that those disorders ought not to be ranked among the class of suppurations or abscesses. A remarkable case of this nature is related in the *Medical Essays of Edinburgh*^f, of a woman who had a tumour for some months upon the external part of the leg, more prominent and soft in the middle, with a manifest fluctuation when it was pressed by the fingers. As the skin of the part looked red, was attended with an acute pain, a hec tick fever, night sweats, and a diarrhœa returning every third day, *etc.* it therefore seemed most adviseable to incide or open the part. And therefore after maturing cataplasms had been applied for two days, and the integuments were much extenuated, so that an evident fluctuation might be perceived, an incision was then made sufficiently deep, to the length of an inch and a half; but though the tumour was thus opened, it did not discharge a drop of matter, but there flowed out about two or three ounces of mucus. On the day following a fungous mass appeared, sprouting up through the opening, which being removed, grew again, and after a large quantity of this substance had been cut off, upon introducing

^e Lib. IV. cap. 18. pag. 64.

^f Medical Essays, Tom. I. p. 234.

the probe, it passed quite through the substance of the leg, till it touched the skin on the opposite side. A few days afterwards the woman died, and the skin of the affected leg appeared sound, but the panniculus adiposus, together with the muscles, were changed into a fungous mass, so that none of the muscles could be distinguished, even by a diligent examination. The periosteum had here receded on all sides from the bones. From this case it is evident that the muscles may be changed into a shapeless mass by diseases, but yet there was no matter found there, which is very remarkable. Perhaps Hippocrates ^s might intend the same kind of abscess, when he says, *Verum, ut summatim dicam, cætera quoque omnia, quæ mucosa sunt, et mucos producunt, utpote glutinosa, ubi tangantur, subito in hanc vel illam partem sub digitis elabuntur, quam ob rem profundius inveniunt hæc Medici, quam putant,*

“ But to speak in brief, all other parts which are
 “ mucous or produce a mucus, as being glutinous
 “ when they are touched, they suddenly slip from un-
 “ der the fingers to this or that part, and therefore the
 “ physicians find the matter seated deeper than they
 “ imagined. For in this place he treats of a frac-
 ture of the ear, followed with a suppuration; and ob-
 serves that if the incision ought to be made, it should
 not be small, because the matter is more deeply seated
 than any one would imagine; and a little before he
 observed, that cataplasms applied to the ear, were pre-
 judicial, as they excited abscesses with a great deal of
 mucus and troublesome suppurations; and then he
 subjoins the sentence which we have just quoted from
 him.

There does not therefore seem to be much danger of injuring the fibres in opening a mature abscess, and therefore that caution is needless which is so largely described by Fabricius ab Aquapendente ^h, almost in

^s De Articulis. Charter. Tom. XII. pag. 363.

^h De Chirurgicis Operat. cap. 107. pag. 654.

every part of the body of which he treats; that is, to make no incision but according to the course of the subjacent muscular fibres; for even that same author confesses afterwards in the same chapter ⁱ, “ that those
 “ who are ignorant of anatomy cannot err in the
 “ opening of an abscess, by reason of the quantity of
 “ matter which elevates the skin, and secures the sub-
 “ jacent parts from the knife.”

The abounding matter is afterwards to be gently pressed out at several times.] In the larger sort of abscesses, in which there is a very great quantity of matter collected, it does not seem to be always safe to discharge the matter intirely at one and the same time. For all the parts which invest the abscess, were before very much compressed by the matter, and if they were freed from the pressure one moment, they would become very flaccid, and admit a great quantity of blood in their vessels, so that less blood would be sent to the brain and cerebellum, whence a fainting and death itself might follow. The same danger is also at hand, if a part is suddenly set at liberty from the pressure which it received from any other collected humour; whence Hippocrates ^k observes, “ that those expire
 “ who have the water or matter intirely discharged,
 “ after the operation of perforating or cauterizing in
 “ an empyema or a dropsy.” But if the abscess is seated in such a part of the body, that the parts may be compressed by bandage, in proportion to the quantity of matter discharged, then the greatest evacuations may be safely performed at once, as we shall declare when we come to treat of the cure of an ascites by paracentesis. Nor will it be at all injurious to leave a quantity of matter in the abscess, for its cavity being covered as it were with a natural balsam, will be fomented and deterged, the half dead ends of the vessels will be separated, and the whole better disposed to

ⁱ Pag. 662.

^k Aphor. 27. Sect. VI. Charter. Tom. IX. pag. 263,

heal, as we said more at large in the history of wounds, § 158. numb. 7, 8, and 9. It is only necessary not to let so much matter remain as to injure the parts by distending them, or so as to occasion it to penetrate into the panniculus adiposus; both which will be prevented, if the opening is left free, and made in such a part of the tumour, that the redundant matter may flow out by its own weight. Whence great caution is to be used that the opened abscess,

[Be neither molested by the admission of the air, nor by the use of tents.] After the abscess has been opened, even though all its matter was discharged, yet more will be collected there again in the space of about four and twenty hours, and sometimes sooner, which will also require to be discharged in the same manner. Therefore surgeons who were fearful, lest the lips of the divided abscess should unite too soon, usually introduce tents to prevent the orifice from concreting. But such tents formed of dry scraped lint, swell very much by absorbing the contiguous humours, by which means, as they are of a conical figure, they are thrust out in a little time, or else if they are retained by the application of plaisters and bandages, they stop up the orifice like a cork, and prevent any discharge of the matter, which therefore endeavours to make itself new passages into the panniculus adiposus, which is too easily dilatable. Besides, these tents gradually lacerate and distract the lips of the opening, while they swell by absorbing the humours; from whence a painful tumour and a new inflammation often arises. It is therefore evident that tents are in this case either useless or pernicious. But when the apparatus or dressings are renewed, and the tent is extracted to discharge the matter, there is then a passage given to the air into the empty cavity; but how pernicious the air may prove by drying up the extremities of the tender vessels, which are naturally open, has been said in the commentaries on § 204. and 245.

The best method of all therefore will be to keep the opening always covered with a flat pledgit, so that the matter may continually flow out with ease, taking care also that neither the bandages nor plaisters press upon the orifice; but rather make a gentle pressure upon the circumjacent parts, by an artificial application of compresses and bandage; and thus the matter may be derived towards the open orifice, which is free from any manner of pressure. But the use of tents in open abscesses seems to have been long ago suspected, even by Celsusⁱ, when he says, *Tum, si quæ in alis, vel inguinibus sunt, sine linamento nutrienda sunt. In cæteris quoque partibus, si ima plaga exigua est, si mediocris suppuratio fuit, si non alte penetravit, si febris non est, si valet corpus, æque linamenta supervacua sunt. In reliquis, parce tamen, nec, nisi magna plaga est, imponi debent.* “ For if any of them are seated either
 “ in the arm-pits or groins, they are to be incarned
 “ without lint. Also when in other parts the bottom
 “ of the opening is but small, if the suppuration was
 “ but moderate or superficial, and not attended with
 “ a fever or disorder of body, the use of lint is even
 “ there unnecessary. In others lint is to be used but
 “ sparingly, or not at all, unless the wound is large.”
 See what has been said concerning the ill effects of tents in the commentary on § 299.

S E C T. CCCCXI.

L Astly, the abscess is to be treated with medicines which mundify, suppurate, digest, heal, deterge, or dry, according to the different nature of the case, and agreeable to the doctrine of wounds from § 192, to 220.

We come now to treat of those curative indications which are mentioned in the two last numbers of § 402.

^f Lib. V. cap. 28. pag. 327.

namely in what manner the opened abscess is to be cleansed and reduced to the state of a clean wound. For the whole internal surface of the abscess has been macerated for some time in the confined matter, by which means it is almost constantly more or less diseased, as was said in the commentary on § 402. numb. 5. It will be therefore necessary to cleanse this internal surface, and separate all those parts of the solids and fluids, which are so far corrupted as to impede the union of the other sound parts. But the surface of the abscess will be the foulest of all, if the matter by being too long confined, has changed its balsamic quality into an acrimony; for then it in a manner consumes the adjacent parts of the skin and panniculus adiposus: but it would be impossible to unite or heal the parts thus foul before they are cleansed, as hath been very justly observed by Galen^a, when he says, *quum vero cutis in suppurationibus amplius extabuerit, ita ut attritis vestium fragmentis similis reddatur (ὡς παρώδες γυνέσθαι) difficulter subjētis corporibus coalescit; itaque emissario largiore factō ulcus necessario curandum est.* “ But when
 “ the skin is so much extenuated in large suppurations,
 “ that it resembles the rags of a worn-out garment,
 “ it very difficultly unites with the subjacent parts, and
 “ therefore it will be necessary to cure the ulcer by en-
 “ larging its opening or discharge.” But what remedies are required to depurate a fordid ulcer, and to reduce it to the state of a clean wound, has been declared before, in the history of wounds, especially in the commentaries on § 204. and the following to 210.

^a Method. Med. ad Glaucon. Lib. II. cap. 9. Charter. Tom. X. pag. 384.

S E C T. CCCCXII.

IF the patient is possessed with a needless fear of the knife, a caustick may be applied to the part which points (410), and the eschar being softened with fresh butter, may be afterwards separated, and the rest of the treatment conducted as before (at § 410, 411.)

A mature abscess may be most safely opened by the scalpel; but sometimes the surgeon is concerned with a patient of so pusillanimous a condition, as even to faint away at proposing the knife; tho' even in these cases, it is best to deceive the patient and open the abscess by incision when it is not suspected. Various machines have been invented by surgeons for this purpose, as the concealing of a lancet in a ring upon their fore-finger, or else a lancet being fixed with its points through a plate of metal, the plate is then covered with some cataplasm or ointment, and being applied to the part, the business is easily performed, by pressing the point gently over the part to be divided. There are several other contrivances of this nature to be met with in Parey^a and others. But if even by this means the necessary opening cannot be made in a mature abscess, nothing then remains but to apply a caustick, or potential cautery as it is called by the surgeons, to the pointing part of the abscess: of these causticks there are several kinds in the shops, such as the lapis infernalis, or the common caustick composed of quick lime and pot-ashes, (see the *Materia Medica* corresponding to this aphorism) which are those chiefly in use. First a plaister is applied to the part, in which there is a small aperture corresponding to that part of the skin to which the caustick is to be applied; and to this aperture the caustick is then fixed and retained by

^a Livre VII. chap. X. pag. 167.

applying another plaister over the whole, and thus the apparatus is left on for an hour or two, or till the eschar is burnt sufficiently deep. After this the eschar is separated from the living parts, by dressing it with basilicon, fresh butter, or the like, and then the matter is discharged through the aperture as before made, after which the cure may be conducted as where directed. But it is certain that those who are afraid of the knife suffer more pain from the caustick; for a mature abscess is divided by the scalpel in a moment, whereas a caustick is obliged to lie upon the part an hour or two, or even longer, and after all there is still a considerable pain felt when the eschar is gradually separated from the contiguous living parts; to which add, that a caustick usually produces a greater deformity in the cicatrix.

Of FISTULÆ.

S E C T. CCCCXIII.

FROM what has been said, the origin, cause, nature, situation, and effects of sinuses and fistulæ may be understood (§ 406.)

When we enumerated the ill consequences from a too long retention of mature matter in an abscess § 406. we observed that the matter by its weight, motion, and acrimony, might create sinuses and fistulæ of different kinds in different parts of the body. We are therefore to treat of these sinuses and fistulæ in the following aphorisms.

But the word sinus is used among physicians and surgeons, to denote a cavity in the soft parts of the body, which have been removed from their contacts with each other, by the matter collected in an abscess, afterwards discharged either by a natural or artificial opening. For such is the definition of a sinus given by Galen^a in treating of this subject, when he

^a Commentar. 2. in Lib. Hippocrat. de Medici Officina, text^u 27. Charter. Tom. XII. pag. 64.

says, *Quoad enim pars ita affecta nullam aperturam habet versus exteriorem superficiem, abscessisse ipsa quidem dicitur: affectio autem abscessus vocatur. At ubi aliqua ex parte aperta est, sic ut excernatur contentus humor, affectio non amplius abscessus, sed sinus jam appellatur;*

“ For when the part thus affected has no opening towards the external surface of the body, it is then said to have absceded, and the disorder itself is termed an abscess: but when there is an aperture so as to discharge the contained humour, the disorder is no longer called an abscess but a sinus.”

Now it follows from this definition, that a sinus must necessarily follow after every abscess; but yet it has been customary only to call it a sinus when the sides of the abscess which has been opened and freed of its matter, do not unite speedily together, even though they remain contiguous, but continue a long time divided; and therefore there will be a collection of fresh humours made every day in that cavity, which will retard the cure. Hence we find the following definition of a sinus given us by Galen^b in another place, *Quum corpora pus excoriat, et continentia a subjectis separat ac diducit; deinde eo (pure) quomodocumque evacuato, separata nequeunt pristinam constitutionem recuperare, affectio sinus appellatur:* “ As the matter excoriates the parts, and separates or dissolves the containing parts from those which are subjacent; then that matter being some way evacuated, the divided parts cannot recover their former continuity, and the disorder is termed a sinus.” The like he also says in another place^c. For after having taken notice, as we said in the commentary on § 411. that the skin is so wasted in suppuration, as to resemble the fragments of a worn-out garment, and very difficultly unites with the subjacent parts; he then immediately adds in the

^b Galen. de Tumor. præternatur. cap. 4. Charter. Tom. VII. pag. 316.

^c Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 485.

beginning of the following chapter; *Quum amplius subiectis finus corporibus cutis coalescere non potest, ejusmodi affectus appellatur.* “As the skin can now no more
 “unite with the subjacent parts, such a disorder is called
 “a sinus.” Even this same definition of a sinus is given us almost in the words of Galen by Paulus Ægineta ^d.

But a fistula differs from a sinus in that it is narrower and generally of a longer standing, having its orifice and internal surface frequently covered with a callus. Hence we have the following definition of a fistula given by Ægineta ^e, *fistula sinus est callosus, plerumque ex abscessibus nascens, ducta ab arundineis fistulis translatione appellata.* “A fistula is a callous sinus,
 “generally arising from an abscess, and deriving its
 “name, from a reed-pipe.” And in another place he adds, ^f that fistulæ generally arise from abscesses which have not been well cured. But the latin Hippocrates, Celsus ^g, having told us in a few words, that fistulæ arise from abscesses and other kinds of ulcers, defines them by saying, *Id nomen est ulceri alto, angusto, calloso*; “this is the name of a deep, narrow
 “and callous ulcer.”

Origin.] The rise of sinuses and fistulæ is evident enough from what has been said in the commentaries on § 406. for a phlegmon being changed into an abscess if its matter is too long confined or discharged by too narrow or high an opening, so that it cannot easily escape, it gives birth to sinuses and fistulæ.

Cause.] That is, good matter by its weight and bulk making a passage into the cellular membrane which is very easily dilatable; or else the same matter corrupted by stagnating, and rendered so acrimonious as to corrode the adjacent parts.

^d Lib. IV. cap. 48. pag. 69. versa.

^e Lib. IV. cap. 49. pag. 70.

^f Lib. VII. cap. 77. pag. 93. versa.

^g A. Corn. Cels. Med. Lib. V. cap. 38. n^o. 12. pag. 328.

Their nature.] Consisting in a preternatural cavity amongst the soft parts, removed from their usual contacts by a collection of purulent matter, ichor, sanies, *etc.*

Seat.] This is always in the panniculus adiposus; nor do I know that it has ever appeared from any credible observations that the proper substance of the muscles has been at any time pervaded by fistulæ. We observed in the commentary to § 374. how largely the panniculus adiposus is extended, so as to involve the whole body, and almost every particular part thereof; it being not only continued round the muscles and tendons, but also inserted betwixt the sub-divisions of the muscles into their lesser portions, even as far as the eye can trace them. From whence it is evident that sinuses and fistulæ may often turn and wind in a surprizing manner, and often penetrate to a very great depth from their opening, as surgeons frequently find and testify by many observations. A young man aged twenty two years, was troubled with a most acute pain, for above the space of six weeks, which invaded the loins, inguen and nates of the right-side, obliging the patient to lie night and day upon his back with his knees drawn up, and his feet bent towards the nates. After the best remedies had been used without success, no change of colour could be observed in the skin of the painful parts, nor any alteration of their figure; but at the side of the vertebræ of the loins, there was a deep undulation to be perceived (like that of matter) betwixt the spine of the os ilium, and the last of the false ribs. This part being deeply incised with a scalpel to the length of near three inches, discharged above six pounds of pure matter: and an incredible quantity of matter was also discharged afterwards in the latter part of the same day from the opening, which overflowed the patient's bed, unknown to him, but to the great relief of his pains. When the surgeon removed the dressings and pressed the abdomen, there was again a large quantity of matter discharged, and still much more, when the leg and thigh of the same side were

were compressed, though there was no apparent tumour in those parts. On the following days when all the matter had been discharged as near as possible, by compressing the thigh and abdomen, there was still a large quantity of matter again expelled by beginning a compressure at the foot and continuing it up to the knee^b. From this surprizing case it appears that good matter not at all ill conditioned, may by its weight only, as it should here seem, make itself passages from the loins, down even to the bottom of the foot; insomuch that though the whole habit of the patient's body was so wasted by this large suppuration, that one might easily span or grasp the top of his thigh with one's hand; yet within five months after the opening made, he was perfectly recovered, and in two months more he entirely regained all that he had lost, and even seemed to be fatter than before he had the disease.

I saw a case of the like nature which had not so successful an event. A soft tumour arose on the left-side, even with the os ilium, and at about the distance of two fingers breadth from the spina dorsi; in a healthy brisk and middle aged man without any manifest cause. The late celebrated Boerhaave being consulted, ordered the tumour to be divided by a large incision with a scalpel, but the fearful patient resisted immediately upon the first touch with the knife, and could not be prevailed upon either by his friends or the threatening events of his disorder to suffer the incision to be made an end of; for there was but a slight puncture made which scarce entered the skin, so that no matter was discharged at that time, but yet by the application of emollient cataplasms for two days to the wounded skin, an incredible quantity of matter made its way out. As all the functions of the body appeared in good condition, there was great hopes of a cure, but the plentiful discharge of matter continued daily,

^b De la Motte *Traité complet de Chirurgie*, Tom. I. pag. 357, &c.

and the surgeon pressing the necessity of dilating the small opening, the patient after delaying many days, at length consented, but did again prevent it from being enlarged as much as it ought, by the resistance he made upon feeling the pain, for he would not suffer himself to be held by any assistance. In the mean time the quantity of matter seemed to diminish for some days, but again after a while an exceeding large quantity of matter vented itself unexpectedly, almost like a torrent. The surgeon with much difficulty obtained leave of the patient to examine which way the sinus tended by his probe, which he could easily pass upwards under the integuments to the ribs; and as the miserable patient obstinately persisted rather in suffering death, than to admit of an easy incision, therefore a new opening was made by the application of the common caustick to that part, where the end of the probe met with a resistance. But though all proper treatment was given with compresses, bandages, a convenient posture of the body, *etc.* it was yet to no purpose, for the matter continued discharging in such quantities as to daily overflow the compresses, bandages, and even the bed itself. In the mean time the patient's body was wasted with a hectick fever, his appetite in the mean time remaining intire, and his bowels neither too much constipated, nor too loose. His body being at length totally emaciated, after some weeks time, a soft tumour appeared in the right inguen as high as the top of the os pubis, by opening which, seven pounds of clean matter were discharged; and yet there was also a continual discharge of matter from that aperture in the groin, as well as from the two others in the back, which at length so much exhausted the patient that he quietly expired, even though his appetite remained good to the last.

As I very much wondered from whence so large a quantity of matter proceeded, and could not imagine that it came from the cavity of the abdomen, through the aperture in the groin, which was the opinion of
the

the surgeon, though there was no apparent tumour of the abdomen, nor any defect in the chylicative organs throughout the whole course of the disease; I obtained leave therefore of the patient's friends to examine the body.

We introduced a probe through the two openings in the back, nor could we make it pass to any considerable length: but when we entered the probe into the opening which had been made in the groin, it passed its whole length without using any force. After drawing out the probe, we introduced a leaden plummet through the same orifice, and passed it gently upwards till it met with a resistance, and then by laying open the tract of the probe by incision, we found that it passed not into the cavity of the abdomen, but that it went up backward above the psoas muscle, under the peritonæum and right kidney; nor could we find any communication betwixt this sinus and the two openings which were made in the back. In the cavities of the thorax and abdomen, there was not so much as a single drop of water to be found; and as we had not observed any disturbance in the functions of the brain, during the whole course of the disease, we therefore refrained from opening the cranium. From hence it is sufficiently evident, that all this matter was lodged in the panniculus adiposus only, since none of the other parts appeared viciated, and there were no apparent signs of a suppuration preceding, nor of any matter contained in the larger cavities of the body.

The effects of sinuses and fistulæ, are like those, which we enumerated in the commentary on § 406. resulting from too long a confinement of matter in a mature abscess: For the matter being retained in sinuses and fistulæ, from whence it can hardly ever be intirely discharged, it is there attenuated and putrified by standing, so as to degenerate into an acrid sanies, and this sooner than in a close abscess, because there is here an access given to the air. The sides therefore of sinuses and fistulæ will be much injured by this corrupt matter, which

which will so much alter them, that it will be afterwards very difficult to cleanse and reduce them to the state of a pure wound, which yet is absolutely necessary to procure an union of the divided parts; and the matter there residing, will also prevent the union of the parts by interposing like a foreign body. It is also from hence apparent, that fistulæ must be the worse conditioned as they are of longer standing, and as they approach nearer to some parts, by an erosion of which we may justly foresee much danger or slowness and difficulty in the cure. Hence Hippocrates^b treating of this subject, says *Fistulæ difficillimæ sunt, quæ in cartilaginosis et carne vacuis locis fiunt, cavæ sunt, cuniculos agunt, et ichore semper manant. Caruncula autem in eorum osculo est. Facilius autem curantur, quæ in mollibus, carnosis, et nervorum expertibus locis contingunt.* “ Those fistula’s are very stubborn, which
 “ are seated in parts cartilaginous and destitute of
 “ flesh; as are those also which are cavernous, and
 “ burrow into the parts, continually discharging an
 “ ichor. But there is generally a caruncle in the
 “ mouth of those fistula’s. But those are more easily
 “ cured, which are seated in soft fleshy parts destitute
 “ of nerves.” A very accurate but somewhat fuller prognosis of a fistulæ, is given us by Celsus^k, when he says, *Expedita curatio est in fistula simplici, recenti, intra carnem. Adjuvatque ipsum corpus, si juvenile, si firmum est. Inimica contraria his sunt: itemque, si fistula os, vel cartilaginem, vel nervum, vel musculos læsit; si articulum occupavit; si vel ad vesicam, vel ad pulmonem, vel ad vulvam, vel ad grandes venas arteriasve, vel ad maxillas, guttur, stomachum, thoracem penetravit. Ad intestina quoque eam tendere, semper periculosum, sæpe pestiferum est. Quibus multum mali accedit, si corpus vel ægrum, vel senile, vel mali habitus est.* “ The
 “ cure is short in a simple fistula which is recent, and
 “ seated in the flesh. The cure will be also assisted
 “ by the body itself, if that is strong and young.

ⁱ Coac. Prænot. n^o. 511. Charter. Tom. VIII. pag. 882.

^k Lib. V. cap. 28. n^o. 12. pag. 328, 329.

“ But the contrary of those oppose the cure, which
 “ will be also difficult if the fistula has injured a bone,
 “ cartilage, nerve, tendon, or muscle, as also if it
 “ is seated in a joint, or if it has penetrated to the
 “ bladder, lungs, womb, large arteries, or veins, or
 “ into the fauces, throat, stomach, or thorax. It is
 “ also constantly dangerous, and even frequently fa-
 “ tal, for a fistula to tend to the intestines. Fistulas
 “ are also rendered much more malignant when the
 “ body is indisposed by disease, old age, or a bad
 “ habit.”

S E C T. CCCCXIV.

AN opened sinus (413.) may be easily dis-
 covered ; but a cavity which is as yet clos-
 ed, is discovered by the softness to the touch.

We come now to enquire by what signs one may discover a present sinus or fistula ; but these are sufficiently evident, when they open outwards in some external part of the body. For if a large quantity of matter is discharged from such a small opening, or may be forced out from thence by pressure, it is from thence evident that there must be a large cavity for containing that matter. But to discover which way the sinus tends, Celsus¹ orders an examination to be made with a probe, where he says, *Ante omnia autem demitti specillum in fistulam convenit, ut quo tendat, et quam alte perveniat, scire possimus, etc.* “ But first of
 “ all it will be proper to probe the fistula, that we
 “ may know to what part, and how deep it pene-
 “ trates,” *etc.* And by the same method he would also have it distinguished whether or no the fistula has penetrated to the bone, as also whether the bone itself is carious. But in order to be assured whether a fistula, opening with but one orifice externally, divides itself afterwards into several branches or

¹ Ibid. pag. 329.

sinuses within, he directs^b the following method to be taken: *Corporis inclinatio docet, num in plures partes fistulæ penetrarint; quia sæpe, cum quis aliter decubuit, aliterque membrum collocavit, pus ferri, quod jam desierat, iterum incipit; testaturque, non solum alium sinum esse, ex quo descendat, sed etiam in aliam corporis partem eum tendere.* “An inclination of the body
 “ will demonstrate whether or no a fistula penetrates
 “ into more parts than one; because frequently when
 “ a patient lies in a different posture, or places the
 “ limb in a different manner, the matter which then
 “ ceased to discharge itself will again flow out, and
 “ not only testify that there is another sinus from
 “ whence it descended, but also that the sinus tends
 “ into another part of the body.” But the best of all methods for discovering the capacity and different course of sinuses and fistulæ seems to be by a prudent and gentle injection of warm water with a syringe. For the water will easily insinuate into all the meanders of a fistula, which if it tends outwards under the integuments, will demonstrate its different course by elevating the skin into a tumour: but if the sinus or fistula descends deep, the quantity of water injected, will then only demonstrate the magnitude or capacity of such a preternatural cavity, nor can much more be discovered by the use of a probe, which if rudely thrust through the orifice of a fistula, often runs into and lacerates, the panniculus adiposus, so as to make sinuses which were not before; nor is it possible to discover the length of a fistula by this means, when in a turning or winding course.

But when a sinus is as yet closed, the diagnosis of it is still more difficult, especially if its situation is very deep: but some light may be had from the signs of inflammation preceding, and the marks of a suppuration following, and if after these a softness and fluctuation is perceived by the touch, we may be cer-

^b Ibid. pag. 330.

tain enough that there is a sinus. Add to this, that a suppuration of any moment seldom lies long concealed in any part of the body without producing a hectic fever. But great prudence is required in determining this matter, to avoid mistaking a latent aneurism or a varix for a deep suppuration, which has sometimes happened; but a skilful surgeon cannot easily run into such an error, if he first carefully considers the origin and progress of the disorder. It must however be confessed, that abscesses have been sometimes observed so latent or deeply situated, as to occasion the most skilful surgeon to be sometimes in a doubt, as is evident from the extraordinary case mentioned in the commentary on § 410. from the excellent surgeon Le Motte, who has candidly described the case, with many others of the like nature.

S E C T. CCCCXV.

Fistulas are cured by opening them in their lower part, by filling their cavities with melted digestives, chose according to the nature of the case, by the injection of deterfives, and by bandage gradually pressing from the bottom upwards, or towards the opening: but the integuments are soonest divided upon a director or grooved cannula, or by a silver wire, or lastly by the syringotomus.

The cure of all sinuses and fistulas, requires in general the following. 1. To procure a free passage to the matter, and to prevent it from standing long so as to corrupt in the sinus or fistula. 2. To cleanse or deterge the internal surface of the cavity of the sinus or fistula, and reduce it to the state of a clean wound. 3. To bring the separated parts now clean into contact, and retain them so as they may grow to each other. Now when the two first requisites are performed, the

third may be easily obtained, as Celsus^c very well observes, when he says, *Neque verendum est, ne purum corpus puro corpori junctum non coëat, adjectis quoque medicamentis ad id efficacibus; cum sæpe exulceratio digitorum, nisi magna cura prospeximus, sanescendo in unum eos jungat.* “Nor is it to be feared that one clean part
 “being joined to another, will not concrete if medi-
 “cines are also used which are efficacious for that
 “purpose; for we see that in ulcerations of the
 “fingers, if we do not take great care in their cure,
 “they are joined into one.” The principal difficulty therefore consists in procuring a free exit to the confined matter, and in depurating the cavity of the sinus; for there are many cases in which this last is very difficult, and sometimes even impossible to attain. Thus I saw a fistula with a narrow orifice opening in the anterior part of the left breast, which descended by a winding passage behind the cartilage of the rib; nor was it possible by any art, to prevent the matter from stagnating in the bottom of this fistula, since the cartilage of the rib made a compression impracticable, and an opening of the fistula dangerous if not impossible. Celsus^d indeed would have a part of the rib cut out in such a case, that no corrupt matter may be left behind; but I believe no one will readily cut out a portion of the rib in a living person, and afterwards pull it off from the pleura to which it firmly adheres. The patient now mentioned, had undergone all methods that could be tried, but without success, and was destroyed by the disorder which was unavoidable, dying in about two years after. Thus also when a fistula has extended to the bone and infected the same, the parts cannot be depurated before that portion of the bone is exfoliated naturally, or else removed by art. Such fistulas very often occur about the jaws, which often continue years, and give way to no re-

^c Ibid. pag. 332.

^d Lib. VII. cap. 4. n^o. 2. pag. 412.

medies; but after a tooth has been drawn, even a sound as well as a carious one, which by coming thro' the socket of the jaws, continually injured and irritated the adjacent soft parts, they are then often cured in a few days time. But for the cure of fistulæ the following methods are principally recommended.

To open them in their lower part by incision.] If the orifice of the sinus or fistula is so placed that the humours contained in its cavity cannot discharge themselves by their own weight, the cure is always difficult; for they will be accumulated and increase the preternatural cavity. Therefore skilful surgeons always endeavour to make a new opening in the lower part of the sinus, that the matter, sanies, *etc.* may discharge themselves spontaneously. But if they are doubtful in what part the bottom of the sinus or fistula is seated, they stop up the orifice with a tent for the space of twenty-four hours, in such a manner, that nothing can be discharged; and thus by confining humours, they make a tumour in the most depending part. The same thing is also performed by a prudent injection of warm water. By this method indeed the collecting humours are prevented from stagnating in the cavity of the sinus or fistula, but then the whole internal surface very often remains foul, fordid, or even callous, which therefore makes a depuration necessary.

By filling the cavity with liquefied digestives chose according to the nature of the case.] In what manner fordes of the like nature formed in wounds, are to be removed, has been said in the commentaries on § 207. and the same remedies will be here proper either of a milder or more acrid nature, according as the fordid parts are thicker, or the internal surface of the sinus or fistula more or less callous. Now in an open wound it is very easy to apply these remedies to every point of their surface, but not so in a winding fistula. The antient physicians used collyria for this purpose, by which name we are to understand a sort of cone or tent; for notwithstanding that term is at present generally used to denote

those remedies of the shops, which serve for the cure of diseases in the eyes, yet it was used in a more ample sense among the antients, for Gorræus^d proves from the best authors, that κολλήσιον is as much as to say a tail cut off (κολλήσιον). Thus Celsus^e also recommends a plaister for the cure of simple and recent fistulas in the flesh, which was applied for recent wounds, provided it contains some salt, allom, verdigrease, or rust of brass, *etc.* And he then adds: *Exque eo collyrium fieri debet altera parte tenuius, altera paulo plenius. Idque ea parte, qua tenuius est, antecedente demitti oportet in fistulam, donec purus sanguis se ostendat, etc.* “ And of
 “ this a collyrium ought to be formed small at one end,
 “ and a little larger at the other: and this is to be in-
 “ troduced into the fistula with the smallest end fore-
 “ most till clean blood shews itself,” *etc.* The whole intention seems to have been by this method to apply such medicines to every point of the internal surface of the sinus or fistula, as might separate the sordes or consume the callus there seated. The best method seems therefore to be not barely to add the aloes, myrrh, olibanum, verdigrease, *etc.* to the substance of a fat plaister, but rather to mix them with honey or the yolk of an egg, for then they may be dissolved by the affluent humours, and act with more power on the parts to which they are applied, and as they are thus reduced to a fluid state, they will be more equally distributed throughout the whole extent of the sinus or fistula. Add to this, as collyria are required to have a solid form to convey them through the orifice to the bottom of the fistula, therefore if they do not gradually dissolve or melt, they will contuse or press the adjacent soft parts, like a foreign body, and by that means do more harm than good. For this purpose therefore let some balsam, for example, turpentine, be taken and mixt with an equal quantity of the yolk of an egg, and to these well incorporated add honey and other detergents according as the case may require; and of these let a

^d Definit. Med. pag. 324, 325. ^e Lib. V. cap. 28. pag. 330.

hollow cone be formed of a solid consistence like the ancient collyria, or rather a more fluid form of medicine, which melting with a gentle heat may fill up the whole cavity.

By the injection of deterfives.] It is very evident that the preceding method can take place only where the sinus or fistula is simple and runs in a strait course; but when the fistula takes a winding course, or as it were, divides into several branches, there is then occasion for other means. For then we ought not to use collyria: as Celsus tells us^f, *Quod unam partem curet, reliqua omittat; sed eadem medicamenta arida in calamus scriptorium conjicienda sunt,isque ori fistulæ aptandus; inspirandumque, ut ea medicamenta intus compellantur. Aut eadem ex vino liquanda sunt, vel, si sordidior fistula est, ex mulso; si callosior, ex aceto; atque intus infundendum, quidquid inditum est.* “Which cure only one
 “ part and omit the rest, but we are also to throw in
 “ dry medicines through a writing quill, adapted to
 “ the mouth of the fistula, blowing through the quill
 “ to drive in the medicines. Or else the same medi-
 “ cines are to be dissolved in wine, or in mead if the
 “ fistula is fouler than usual: but in vinegar if it is
 “ more callous, and the things thus prepared, are to
 “ be injected or poured into the cavity.” All those remedies therefore which serve occasionally for the preparing of collyria being diluted in some convenient liquor, are usually injected through the mouth of the fistula; and of this nature there are various forms of remedies to be found in the *Materia Medica* corresponding to this aphorism. But it must be observed, that these injections are often prejudicial, if they are urged in too violently, for then they may easily make new passages into the panniculus adiposus, and by that means increase the disorder; and besides this, they are all serviceable only inasmuch as they remove the sordes, and consume the callosity of a fistula; but after the

^f Ibidem. pag. 332.

parts have been once depurated, they will be rather injurious by preventing their union; for even the best balsams interposed betwixt wounded or divided parts, do like foreign bodies prevent them from healing and uniting. Therefore Celsus^b advises us to use agglutinating medicines only, *Si ea tunica, quæ inter foramen et integram carnem est, veſta tot medicamentis exeat, infraque ulcus purum ſit*: “When that coat or ſkin
 “ which is ſeated betwixt the opening and the ſound
 “ fleſh, is ſeparated and diſcharged by the many re-
 “ medies, and leaves the ulcer clean underneath.” For then he orders the application of a ſponge dipped in boiled honey, and condemns the collyria; ſince there can be no danger of one clean part conjoining with another, as we obſerved a little before from the ſame author. But the whole internal ſurface may be known to be clean, if it diſcharges a white, ſmooth, and uniform matter without any ſanies or ichor, and without any ſœtid ſmell. Thus for example, a tent or collyrium being introduced into a ſinus or fiſtula, as alſo the plaſter or pledget covering its orifice, is diligently examined by the ſkilful ſurgeon when he renews the dreſſings, in order to perceive whether they are moiſtened in any part with a thin ſanies inſtead of laudable matter; for then they are aſſured that all the compaſs of the ſinus or fiſtula is not yet depurated.

By bandage preſſing gradually from the bottom towards the opening.] The beſt matter corrupts by ſtagnating, and degenerates into a thin and acrid ſanies, ſee the commentary on § 402. numb. 4. ſo that although the internal ſurface of the ſinus or fiſtula has been well cleaned, new ſordes will be again formed, unless the ſtagnation and corruption of the matter can be prevented. But in order to effect this, an artificial compreſſure by bandage is of the greateſt efficacy, joined with ſuch a poſture of the part, as that the collected matter may paſs freely out through the orifice of the fiſtula, and not at all ſtagnate or be collected in its bottom. Thus we read in Galenⁱ, that a ſinus

^b Ibidem.ⁱ Ibidem.

which

which descended through the thigh and terminated at the knee, whose original orifice opened above the middle of the thigh, was cured, without making any counter opening, by fixing soft compresses or pillows under the ham, so as to raise it higher than the inguen. But the bandage ought to be such as by a gentle pressure may retain the clean parts in contact. Now as even in a clean wound of any moment, there is matter daily formed, it ought to be capable of a discharge; and therefore the sinus is not to be compressed by compresses and bandage all at once throughout its whole length, but by proceeding gradually from the bottom to its opening. Therefore the fundus or lowest part of the sinus is to be diligently sought for: but this may be discovered by a prudent injection of mead or the like deterging liquor, serving to depurate fistulas, if attention is at the same time given, how far and towards what part the liquor tends, which may be also known by beginning a gentle pressure upon the parts below, and continuing the same upwards so as to expel the matter contained in the sinus; for when the pressure made upon the adjacent parts has extended to the bottom of the sinus, the matter will then begin to flow out through its orifice. The part being thus discovered, in which the bottom of the sinus or fistula is seated, if the surgeon is assured that the whole internal surface of it is clean, he then applies a compress to that part, by which means it determines the pressure by his bandage, so as to reduce the clean parts at the bottom of the fistula into contact; the remainder of the sinus or fistula being only retained loosely with a spiral bandage, while the orifice remains open, to allow of a free discharge to the contained matter. Galen^h has very well described this method, in treating of the various methods of curing sinuses, where he says: *Colligatio autem a fundo sinus quidem incipiat, finiatur autem in ejus orificio. Fasciarum vero circumductiones sine dolore fundum sinus premant, quæ paulatim*

^h Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 386.

usque ad orificium (sinus) laxentur; “ But the bandage is to begin at the bottom of the sinus and terminate at the orifice; but the circumvolutions of the bandage are to press so gently upon the bottom of the sinus, as not to give any pain, and are to be laid on more loosely by degrees, till they come to its orifice.” He also observes that a plaister ought to be applied to the orifice, with an aperture cut in it by a pair of scissars, to give a discharge to the matter when there is any, *etc.* At the following dressings all the matter is to be gently pressed out before the compress is removed from the bottom of the sinus, to which it was applied, and after removing the compress, an attempt must be made to express what other matter is lodged in the adjacent parts; and if any quantity of matter is then discharged, it is a sign that the compress was not applied low enough, but that matter is as yet contained beneath it, and therefore it will be proper to alter its situation; but if no matter is then found to discharge itself, the compress is to be applied a little higher up towards the mouth of the sinus, ascending a little at each dressing, and with the like precautions; by which means a concretion of the separated parts, will begin in the bottom of the sinus, and proceed gradually towards its orifice. Hippocrates^k expresses this matter with his usual brevity when he says, *Quæ abscesserunt, ut sublimia sint, naturalem sedem tangere quidem debent, non vero comprimi*: “ For those parts to fill up which have been wasted, they ought to touch each other without being compressed,” (for that this is the sense of this obscure passage, appears from the commentaries of Galen to this text.) “ This contact is to begin in the sound parts, and terminate at the opening of the sinus, that what matter is confined may be depressed or milked out, and no more be collected.” But the term milked out seems to be here very proper

^k Hippocrat. de Medici Officina, Textu 27. Charter. Tom. XII. pag. 63.

to express a gradual derivation of the matter from the bottom of the sinus towards its opening made by a gentle pressure in the same manner as the milk is forced out by a gentle pressure continued from above downwards in the milking of a cow, while the orifices of the teats remain open. But the signs by which we know that the cure in this case succeeds, are very well enumerated by Galen¹ as follows, *An vero sinus profundum pulchre conglutinatum fuerit, hæc tibi sit diagnosi ex sanie effluente : si pauca vel multa sit, cocta vel cruda. Præterea si circa ipsum sinum neque dolor sentiatur, neque tumor appareat, sed totus locus æquabilis sit, siccus, ac doloris expers. Quod si puris probe cocti pauculum in orificio, videris, multo magis de glutinando sinu sperandum est.*

“ But whether or no the bottom of the sinus is well
 “ conjoined, take your diagnosis from the effluent
 “ matter : according as that is either in a large or
 “ small quantity, and crude or concocted. As also
 “ when there is no pain felt about the sinus itself, nor
 “ any tumour appears, but the whole part seems even,
 “ dry and without pain. But if you should see only
 “ a small quantity of pure concocted matter in the
 “ orifice, there is still more reason to hope for the
 “ agglutination of the sinus.” But though this method may succeed very well in many instances, yet it is evident enough that it cannot take place, unless the whole surface of the sinus or fistula is very clean, and acted upon by an external pressure. Therefore when a fistula arises from an injury of the subjacent bone, or has not been first well deperated of its callosity, or if it runs in such a manner that an external pressure cannot reach to its bottom, the only method that then remains, is to lay open the integuments by incision, that suitable medicines may be applied to the whole surface of the fistula.

¹ Galen. Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 386.

But the integuments are the soonest divided by incision upon a grooved probe or director.] The most expeditious method of curing a fistula or sinus, is to convert it into an open ulcer, by dividing the integuments; for the difficulty of the cure does not arise so much from the internal callosity, as from the matter which there stagnates and corrupts. It appears from the most faithful observations, and from many cases of this nature, which I myself have seen, that fistulæ have been cured within the space of fourteen days, barely by incision, when other methods have been tried in vain for many months or even years. Celsus^m being well acquainted with this matter, therefore pronounces, *Adversus fistulas quoque, si altius penetrant, ut ad ultima demitti collyrium non possit, si tortuosæ sunt, si multiplices, majus in manu, quam in medicamentis præsidium est; minusque operæ est, si sub cute transversæ feruntur, quam si recta intus tendunt. Igitur, si sub cute transversa fistula est, demitti specillum debet, supraque id ea incidi. Si flexus reperiuntur, hi quoque simul specillo et ferro persequendi sunt. Idemque faciendum, si plures se quasi rivuli ostendunt.* “ But for the cure of those
 “ fistulæ which penetrate so very deep or run so wind-
 “ ing, or branched out, that a collyrium cannot be
 “ conveyed to the bottom, the cure is then to be rather
 “ expected from manual operation than the use of me-
 “ dicines; and the cure will be still more expeditious
 “ by the operation, if the fistula runs transversely un-
 “ der the skin, than if it tends directly inwards.
 “ Therefore in a transverse subcutaneous fistula, a probe
 “ or director is to be introduced, upon which it is to
 “ be laid open by incision. If any turnings are found
 “ in the fistula, these are also to be followed and laid
 “ open by the knife or director. The same is to be
 “ also done, when the fistula appears to divide itself as
 “ it were into several branches.” There are indeed many boasted remedies or arcana for the cure of stubborn

^m Lib. VII. cap. 4. n^o. 1. pag. 412:

fistulæ without cutting, but how little we ought to confide in them, appears from the instance of the late French king Lewis XIV. who being disordered with a fistula in ano, had an infinite number of remedies proposed to him, the principal of which were made trial of by the king's order, upon patients afflicted with the same disease, but all without effect: and though a whole year was spent in these trials, the king at length submitted to, and resolutely underwent, the operation, even though the surgeon ⁿ was obliged to lay open all the branches of the fistula by many incisions. But that this incision may be safely performed without injuring the adjacent parts, surgeons have contrived various methods. For when the fistula runs immediately under the integuments, it may be then sufficient to introduce a director carefully through the orifice of the fistula down to its bottom; and then to make an incision by guiding the knife or razor along the groove of the director, so as to cut through all the parts which are intercepted betwixt them. But when the course of a fistula tends more inwards, as it very frequently does when seated in the anus, in that case it is customary sometimes to use,

[A silver wire.] Formed of the purest silver heated red hot, and suffered gradually to cool, to render it the more pliable, and being also furnished with an obtuse end like a probe, which is conveyed through the opening of the fistula, entering it by degrees till it has reached the bottom, and one may perceive the obtuse end under the integuments: then an incision being made in that part, the wire is drawn through and the two ends of it are then drawn up, so as to remove the integuments from the subjacent parts, that they may be safely divided either by the scalpel or scissors.

This was the method formerly used for the curing of fistulæ in the anus by incision, for they introduced

ⁿ Dionis Cours d'Operations de Chirurgie, Demonst. 4to. pag. 228, etc.

such a probe through the external orifice of the fistula, until the surgeon could perceive the extremity of it coming into the anus by introducing his forefinger up to the internal orifice of the fistula, or if there was no entering an orifice, they boldly perforated the intestine with the end of the probe. They then bent the end of the probe with their forefinger, and brought it out through the anus, so that by pulling the two ends of the wire, they extended the parts which were to be divided, that is not only the common integuments, but also of the sphincter ani, and part of the *intestinum rectum* were to be divided in this case°. Hippocrates^p has still another method of curing fistulæ of the anus: He orders a probe of tin, the eye of which is to be armed with five threads, circumvolved and tied together with a horse-hair, which is to be conveyed through the orifice of the fistula; then the forefinger of the left-hand being introduced into the anus, the end of the probe is to be bent and brought outward, until the thread follows. After the probe is extracted, he orders the two ends of the ligature to be tied in a knot, and the patient to be then dismissed, that he may go about his affairs like other people who are well. His intention is so to extenuate all the integuments by degrees with a ligature, that they may be at length quite cut through: whence Hippocrates observes, that the ligature is to be tightned every day by twisting in proportion as it becomes looser, by cutting through the fistula; and if the ligature should seem to be corrupted, a fresh one is to be introduced by tying it to the end of the former, which is to be then extracted, and the new ligature tightned as before. Celsus^q very justly calls this a very tedious method of cure; but whether it is without pain, as he also asserts, I very much doubt: For he says, *Paulatim cutem, quæ supra fistulam est, incidit, simulque et id sanescit, quod a lino relictum est, et id,*

° Ibid. pag. 285; P De Fistulis, cap. 3. Charter. Tom. XII. pag. 142. q Lib. VII. cap. 5. n°. 4. pag. 414.

quod ab eo mordetur, inciditur. “ That the ligature
 “ gradually divides the skin which is above the fistula,
 “ while in the mean time those parts heal, which have
 “ been left behind the ligature, and those are divided
 “ which are thereby constringed.” For when by the
 motion of these parts in walking, the ligature is rub-
 bed against the sides of the fistula, it must give no
 small uneasiness; but if the sides of the fistula are so
 callous as not to receive any pain from that attrition,
 then that method will not easily divide the integuments,
 but after a tedious delay recourse must be had to the
 knife itself. But that the preceding method had been
 often used without success, is evident from what fol-
 lows a little after in the same place of Hippocrates.
 For he says: *Si vero fistula non fuerit exesa, demittens*
specillum incide, quo usque illud pervenerit, et insperge
æris florem, et per quinque dies relinque, etc. “ But
 “ if the fistula should not be thus cut through, in-
 “ troduce a probe and lay it open as far as it penetrates
 “ by incision, after which make an asperision of flores
 “ æris, and thus leave it for five days,” *etc.* Celsus
 observes in the place lately cited, that those who are
 in haste to have the integuments divided, ought to
 tighten the ligature: and he likewise observes, that the
 same division will be hastened by spreading the liga-
 ture with medicines which corrode callous parts, but
 then the pain will be greater; and at last he adds, that
 it may be also done by the scalpel, the use of which
 will perhaps be necessary after all, *etc.* He seems
 therefore to undervalue this method by ligature, as it
 makes no discharge or separation of the foul parts, and
 often occasions much pain and uneasiness to the pa-
 tient, as well as trouble to the surgeon.

[Syringotomus.] This instrument is so called from
 its use in cutting fistulæ, and there are various forms
 of it described by authors. It is most commonly re-
 commended for the cure of fistulæ of the anus. The

^f De Fistulis, cap. 4. pag. 143.

instrument is composed of a probe joined to a scalpel or razor, so that by introducing the former through the fistula, a division is then made by the latter, and thus one instrument performs what was to be done by two. But the syringotomi which are represented to us by Scultetus, Van Solingen, Fabricius ab Aquapendente and others, seem to be less commodious for this purpose, and especially for dividing fistulæ of the anus. For here a falciform knife terminates in a probe made of the same metal, so that this last part of the instrument has not the pliability which is required to bend the probe by the finger in the cavity of the intestine, so as to draw it outwards. But the industry of modern surgeons has corrected the defects of this instrument^s, for they unite a probe of pure flexible silver to a crooked knife made of the best steel, while part of the instrument is concealed in a crooked handle; but it may be seen represented by a figure in the end of this book.

The fistula being thus divided, is changed into an open ulcer, and if then it appears to have many branches, each of them are to be divided after the like manner, that there may be no lurking places for the matter to conceal itself in, so as to stagnate and corrupt. But as the internal surface of the fistula is in this case frequently found callous, therefore surgeons usually make scarifications in several places, that the callosity may be the sooner removed by the application of digestives or corrosives. Even Celsus^t would have the whole callus to be cut out, after the fistula has been laid open to its bottom. But every thing which has been said in the commentary on § 411. is also to be observed in this place.

^s Garengéot. Traité des Instrumens de Chirurgie, Tom. I. cap. IX. pag. 286.

^t Lib. VII. cap. 4. pag. 412.

S E C T. CCCCXVI.

FROM what has been said, we may derive a knowledge of the nature, consequences, and methods of treating buboes, parotides, furuncles, or boils, anthraces, carbuncles, phymata, erysipelata, the measles, small-pox, purple spots, and the like.

From all that has been hitherto said in the history of inflammation, and suppuration thence following, we may derive a knowledge of a great many disorders, which may be referred to inflammation, and its consequence as the cause, notwithstanding they are distinguished by peculiar names in common practice. And at the same time also we may be able to deduce their prognosis and method of treatment from the same knowledge. The principal of these disorders are those here enumerated, such as

Buboes.] The Greek physicians denominate the groins (*βυβωνες*) *bubones*, and they likewise denominated the glands there seated, by the same name; nor did they alter the name, even when the like tumour was observed in the glands of the axilla. We even read in Galen ^a of tumours formed in other glandular parts of the body, called by the same name: for he says, *Quinetiam in collo et secus aures sæpe glandule intumescunt, natis ulceribus circa caput, collum, vel aliquam ex vicinis partibus. Nominant autem sic intumescentes glandulas bubones:* “ Also the glands which are
 “ seated in the neck and behind the ears, very often
 “ tumify, and are accompanied with an ulcer about
 “ the head, neck, or some of the other adjacent
 “ parts: but the glands thus tumified are denomi-
 “ nated buboes.” But at present it is customary with

^a Method. Med. Lib. XIII. Charter. Tom. X. pag. 297.

us only to call tumours of the groins and arm-pits by this name. Now these buboes are either inflammatory, suppurating, or scirrhus, all arising from the common causes of inflammation. But there are also buboes which frequently arise in the worst contagious diseases, as in the plague; and sometimes also in the venereal disease, in which last the inflammation is not very sudden or violent, but usually continues a long time before it can be resolved, or else be brought to a laudable suppuration, frequently resisting even the most efficacious remedies. Sometimes also, there is a translation or settlement (*ἀπόσπασις* vel *μετάσπασις*) of the morbid matter with very good success upon these parts, which is then termed a metastasis or apostasis. And even sometimes in men who are healthy in other respects, these tumours suddenly arise without any topical cause, producing first an inflammation, and then a suppuration: and these are the latent efforts of nature, by which she separates those humours from the whole mass of blood, which might prove of worse consequence, without giving any manifest signs of the latent nature of the disease. Hence it is that these parts were esteemed by the antient physicians as the emunctories or drains of the viscera; and Galen says ^b that the glands very easily receive an afflux of the humours, by reason of their weakness and spongy texture. Now if we consider the situation of the inguinal and subaxillary glands, they will appear to be well adapted to receive those humours, which ought to be discharged from the whole habit: for they are placed in the very soft adipose membrane, almost free from all muscular compression, having very large arteries, veins and nervous trunks, near them, from which they receive their branches. But these glands have so great a commerce or consent with the other branches of these nerves, that when they are injured, these glands are often immediately inflamed and swelled. Thus I have frequently seen a very

^b Ibid. pag. 296.

painful paronychia produce a sudden tumour in the axilla, even though the disorder was seated in the end of the finger. When a woman unfortunately run a needle up under her nail, so as to injure the nervous substance which is there seated with the most acute pain, I was surprized to find that in a quarter of an hour after there was a considerable tumour in the arm-pit of the same side. From hence the reason is evident why Hippocrates^c says, *Febres post bubones ortæ, nisi ephemeræ fuerint, malum.* “ Fevers arising “ after buboes, are bad, unless they are (ephemera’s) “ but of a days continuance.” For he here intends that the fever denotes a fruitless attempt of nature to expel the morbid matter by abscess. And therefore fevers arising from such a latent cause must be very stubborn, unless they are ephemera’s, which run thro’ their course, or terminate within twenty-four hours, and signify the strength of nature overpowering the disease. And in another place he says, *bubones febribus succedentes deteriores, si in acutis ab initio decrescant.* “ That buboes arising after fevers are bad if they “ decrease from the beginning in acute distempers.” For these then denote an insufficient endeavour of nature, and in dangerous fevers must be always bad: For buboes seldom appear in fevers, unless they are very acute. I remember myself to have seen buboes in the worst species of the small-pox, and in the plague; all who have wrote upon that distemper testify that they are very frequent.

Parotides.] This name denotes a tumour of the glands behind the ears, which is called parotis by the Greeks, which is as much as to say, an abscess behind or under the ear. They are also by Hippocrates often called τὰ παρ’ ἑς ἐπάρινα, *vel simpliciter τὰ παρ’ ἑς.* What has been said concerning the inguinal and subaxillary glands, as being seated in the soft fat, and freed

^c Epidem. Lib. II. Charter. Tom. IX. pag. 162. & Aphor. 55, Sect. 4. ibidem pag. 170.

from the compressure of muscles, *etc.* The same is also true concerning the parotides; for they occupy that cavity which we find at the root of the ear betwixt the mastoide process of the skull, and the condyloide head of the lower jaw, from whence they are extended downward and backward under the lobe of the external ear. They likewise receive large branches from the adjacent external carotid artery. The tumours of these glands appear much more frequently in diseases than buboes, and Hippocrates from thence deduces part of his prognosis in many distempers, as will hereafter appear. But it may be sufficient for us at present only to remark from Celsus^d, *Sub ipsis vero auribus oriri παρωτιδες solent, modo in secundo valetudine, ibidem inflammatione orta; modo post longas febres, illuc impetu morbi converso. Id abscessus genus est. Itaque nullam novam curationem desiderat: animadversionem tantummodo hanc habet necessariam, ut, si sine morbo id intumuit, primum reprimentibus fiat: si ex adversa valetudine, illud inimicum est, maturarique et quam primum aperiri commodius est.* “But under the ears
 “ themselves the parotides usually arise, as well in an
 “ ill state of health, or after an inflammation in them;
 “ as after long fevers when the violence of the disease
 “ tends to that part. This is a kind of abscess, and
 “ therefore does not require any different method of
 “ treatment; only this caution is necessary to be ob-
 “ served, that if they swell without a disease, trial
 “ ought first to be made with repelling medicines;
 “ but if they arise from an ill state of health, it is from
 “ something offensive to nature, whence it will be
 “ more convenient to mature and open it as soon as
 “ possible.”

[Furuncle or boile.] This is a very painful inflammatory tumour, seated in the external surface of the body, and slowly tending to suppuration, appearing very red, and when once the abscess is opened, there generally appears concreted blood in the bottom,

^d Lib: VI. cap. 16. pag. 391, 392.

whence it is usually denominated a *bleeding-ulcer*. These kinds of abscesses sometimes prove epidemical, and not only invade many men in the same country, but also people of different countries, and appear in different parts of the body. Celsus ^e gives us the following description of a furuncle: *Furunculus vero est tuberculum acutum cum inflammatione, et dolore; maximeque ubi jam in pus vergit. Qui ubi adaptus est, et exiit pus, subter apparet pars carnis in pus versa, pars corrupta subalbida, subrubra; quem ventriculum quidam furunculi nominant. In eo nullum periculum est, etiamsi nulla curatio adhibeatur: maturascit enim per se atque erumpit. Sed dolor efficit, ut potior medicina sit, quæ maturius liberet.* “ But a furuncle is a sharp pointed tumour with inflammation and pain, which are the most violent when it is about turning to suppuration. When this is opened and the matter discharged, there appears underneath, part of the flesh turned to matter, part of it corrupted and of a whitish colour, and part of it a reddish colour, which part is denominated the ventricle or stomach of the boil. There is no danger in this tumour, even though no care be taken of it, for it both ripens and breaks out of itself; but it occasions a pain, and therefore it may be proper to use medicines which soon maturate or free it from the pain.” As a mild resolution can never be expected in a furuncle, the whole intention of the cure consists in bringing it as soon as possible to suppuration; and because these tumours are generally difficult to bring to a perfect maturation, therefore it is usual to add such things to emollient applications, as are capable of exciting a little greater motion in the part to be suppurated: whence Celsus ^f pronounces *proprium furunculi medicamentum galbanum est*; “ that galbanum is a medicine proper to a furuncle.”

^e Lib. V. cap. 28. n° 8. pag. 324.

^f Ibidem.

Anthracis.] When the external skin and subjacent panniculus adiposus, are suddenly corrupted by a violent inflammation, so as to form a dry hard scab or eschar, which being perfectly dead, ought to be separated from the living parts by suppuration, that inflammation is then usually called anthrax or a burning coal. The writers of observations testify, that this is a frequent disorder in the plague, especially when the fury of the disease is mitigated and the latent virus derived to some particular part of the body by victorious nature. But there are two kinds of anthracis described by Galen ^ε, where he treats of the different kinds of inflammation, *Quando influens sanguis admodum calidus fuerit, et crassus in quamcumque partem confestim fluxerit, illam adurit, ulcusque crustam habens efficit. Quidquid autem circumstat, in ferventem inflammationem attollit, et valide dolentem. Vocatur autem ille affectus anthrax. Quod si influens sanguis niger sit, crassus, fœculentus, ac fervidus, qualis est prior, admixtamque quandam sanie[m] habeat tenuem, pustulas in superficie cutis excitat, similes his, quæ ab igne fiunt: quibus ruptis sub ipsis crustosum ulcus invenitur. Est autem hic affectus etiam anthrax.* “ When the influent blood is
 “ very hot and thick, flowing very rapidly into a
 “ part, it burns up the skin, and forms an ulcer with
 “ a crust or scab: But all the circumjacent parts it
 “ raises into a hot inflammation, which is extremely
 “ painful. But this disorder is termed anthrax; but if
 “ the influent blood is black, thick, feculent, and
 “ very hot like the former, being also mixt with
 “ a kind of thin sanies, it causes pustules in the sur-
 “ face of the skin, like those which are raised by
 “ fire; which being ruptured, an ulcer is perceived
 “ under the crust. But this last disorder is also an
 “ anthrax.” The first species of an anthrax is most agreeable to the common sort, but the definition given

^ε Method. med. ad Glaucon. Lib. II. cap. 1. Charter. Tom. X. pag. 269.

of the latter kind, denotes a milder species of the same disorder. The cure consists in procuring a supuration all round the anthrax, so as presently to separate it from the adjacent living vessels; for the substance of the anthrax itself can never be converted into matter. The most emollient remedies only are therefore proper in this case.

Carbuncle.] This is related to the anthrax, but somewhat milder. The modern surgeons generally call by this name an ulceration of the skin in several parts, following after a very violent and painful inflammation, in which there is also some fragments of the panniculus adiposus discharged from the ulcerations. But the disorder which Celsus^h describes by this name, seems to have been different from these carbuncles: for he says, *rubor est, superque eum non nimium pustulæ eminent, maxime nigræ, interdum sublividæ, aut pallidæ. In iis sanies esse videtur; infra color niger est. Ipsum corpus aridum et durius quam naturaliter oportet. Circaque quasi crusta est; æque inflammatione cingitur. Neque in eo loco levare cutis potest, sed inferiori carni quasi affixa est. Somnus urget. Nonnunquam horror, aut febris oritur, aut utrumque. Idque vitium subteractis quasi quibusdam radicibus serpit interdum celerius, interdum tardius* “ That it is red, having
 “ pustules arising upon the surface not very high, ge-
 “ nerally black, but sometimes livid or pale, in
 “ which there seems to be a sanies, and underneath
 “ there is a black colour. The body itself appears
 “ drier and harder than it naturally ought, and about
 “ the edge there is a sort of crust circumvested with
 “ an inflammation. Nor can the skin be taken off in
 “ that part, but it seems as it were fastned to the flesh
 “ beneath, the patient is sleepy, and sometimes taken
 “ with a shivering or a fever, or both. When the
 “ disorder is once fixed, it spreads as it were with
 “ roots sometimes faster and sometimes slower.” The

^h A Corn. Cels. Med. Lib. V. cap. 28. n^o 1. pag. 315, 316.

The cure which he afterwards subjoins, sufficiently proves that these carbuncles were malignant, and perfectly destroyed or mortified the part which they invaded. For he immediately orders them to be cauterized, which he adds, may be done without pain, because that flesh is dead; and he orders the cauterization to be continued until every part is sensible of the pain. But how dangerous these carbuncles sometimes were, is also evident from Celsus in the same place, who says that if this disorder is seated in the stomach or fauces, it often suddenly strangles the patient.

Phymata.] Galenⁱ will have phymata derived from sprouting (*ἀπὸ τῆ φύεσθαι*) for he says: *Ab iis, quæ ex terra progerminant, homines phymata vocaverunt tumores præter naturam, qui omnino sine causa externa proveniunt: sed potissimum sic nominant eos, qui ad externum locum impelluntur. Quia autem aliud nomen non habetur, etiam latos, et paulo naturalibus partibus elatiores (tumores) eodem nomine appellant.* “That phycians have called phymata those preternatural tumours which arise without any external cause, like things which grow out of the earth: but they chiefly call those tumours by this name which are seated externally. But for want of another name they have thus called even broad tumours seated prominent in the natural organs.” From hence the use of this term seems to have been a little uncertain, and that even buboes and other suppurations of the glands, were sometimes thus called, is evident from another passage in Galen^k, where he says: *Imprimis autem quadam phymata appellantur inflammationes nonnullæ spontaneæ, subitissime natæ, citissime in acutum apicem elatæ et celerrime suppurandæ. Et plurima illorum generatio est in inguinibus et axillis, quod in his locis plures sint glandulæ, quæ hanc naturam habent,*

ⁱ Comment. 1. in VI. Epidem. Hipp. Textu. 13. Charter. Tom. IX. pag. 375.

^k Commentar. in Aphor. 26. Sect. 3. Charter. Tom. IX. pag. 122.

ut excrementa promptissime in se recipiant. “ But there
 “ are more especially some spontaneous and sudden
 “ inflammations which are called phymata, which very
 “ soon elevate the skin into a sharp tumour speedily
 “ tending to suppuration. Many of them are formed
 “ in the groins and arm-pits, because in these parts
 “ there are many glands, whose office is readily to re-
 “ ceive the excrements of the blood into themselves.”
 Even Hippocrates ^l terms abscesses which arise after
 long fevers about the joints by the name of phymata;
 and in another place he calls by that name a tumour in
 the urethra ^m itself tending to suppuration; and in an-
 other place ⁿ he so calls a vomica broke inwards. This
 passage of Hippocrates is thus expressed by Celsus ^o,
Quibus in fistula urinæ minuti abscessus, quos Φύματα Græci
vocant, esse cœperant, iis, ubi pus ea parte profluxit,
sanitas redditur. “ In those who have abscesses
 “ seated in the urethra, which the Greeks call phy-
 “ mata, when they discharge matter, they begin to
 “ recover their health.” The same author in another
 place ^p uses the name phymata barely to denote inci-
 pient tumours. But where he treats of the different
 kinds of abscesses ^q, he gives the following more large
 description of a phyma, when he says, *Phyma vero*
nominatur tuberculum furunculo simile, sed rotundius et
planius, sæpe etiam majus. Nam furunculus ovi dimidii
magnitudinem raro explet, nunquam excedit. Phyma
etiam latius patere consuevit: sed inflammatio dolorque
sub eo minores sunt. Ubi divulgum est, pus eodem modo
apparet: ventriculus, qui in furunculo, non invenitur:
verum omnis corrupta caro in pus vertitur. Id autem in
pueris et sæpius nascitur, et facilius tollitur: in juveni-
bus rarius oritur, et difficiliter curatur. Ubi ætas indu-
ravit, ne nascitur quidem: “ But a phyma is a small tu-

^l Aphor. 44, & 45. Sect. 4. Charter. Tom. IX. pag. 163.

^m Aphor. 8. Sect. 7. *ibid.* pag. 295.

ⁿ Aphor. 82. Sect. 4. *ibid.* pag. 191.

^o A. Corn. Cels. Medic. Lib. II. cap. 8. pag. 70.

^p *Idem*, Lib. V. cap. 18. n^o 16. pag. 254.

^q *Ibid.* cap. 28. n^o 9. pag. 325.

“ mow like a boil, but rounder and broader, and
 “ frequently larger. For a furuncle seldom arrives to
 “ half the size of an egg, and never exceeds it. A
 “ phyma also spreads itself usually broader, but then
 “ it has less pain and inflammation. When it is
 “ opened there is also a matter found in it, but the
 “ ventricle is not found here as in a furuncle, but all
 “ the corrupted flesh is changed into matter. It arises
 “ more frequently in children, and is in them more
 “ easily removed; in young people it happens more
 “ rarely, and is more difficultly cured, but it does
 “ not appear at all when age is far advanced.”

From all which it is evident that an inflammatory tumour speedily tending to suppuration, was generally termed a phyma, the knowledge and cure of which is therefore to be deduced from the history of inflammation and abscess.

Erysipelas.] Concerning this, see what has been said in the commentaries on § 380.

Measles] If we consider the account given us by Sydenham, who has the most accurately described the course of the measles from the beginning to the end, it will evidently appear that after a preceding fever, there are small inflammatory eruptions, which arise in the external skin of the face, about the fourth day usually in the regular kind, but sooner or later in those which are irregular, which pustules cohering in clusters, form red spots; and after this the trunk and limbs of the body begin to look red. At length on the eighth or ninth day all this redness again disappears and the broken cuticle appears white and rough upon the surface of the body, almost as if it was sprinkled with flour, and the cuticle falls off in little scales. From whence it is evident that the measles come near to the nature of an erysipelas, since they only occupy the external integuments, or the internal membranous parts of the body, and that they are never followed with a suppuration, but always disappear with a scaling off of the cuticle.

Small-

Small-pox.] These are not erysipelalous eruptions, like those of the measles, but true inflammatory pustules, tending to a mild suppuration, when they are of a mild and good kind, or else to a gangrene, when they are of the worst kind. They not only invade the external surface of the body, but have been sometimes observed likewise in the internal parts of the mouth, fauces, stomach and viscera, as we shall declare more at large when we come to treat professedly of this distemper. It is sufficient at present for us to observe, that they are attended with all the true appearances of an inflammation, ending either in an abscess or a gangrene, and that the general rules which have been given for the cure of an inflammation and abscess, with that of a gangrene following do also take place equally in the small-pox.

Purple or red spots.] By this denomination are called all those cutaneous exanthemata or efflorescences which are sometimes observed after another distemper, and are frequently not attended with any injury of the functions; nor can they therefore be well ranked amongst the other disorders of this aphorism. But of these we shall treat hereafter among the symptoms of fevers on § 723. and the following; and it will there appear that the knowledge and cure of these may be deduced from the history of inflammation.

S E C T. CCCCXVII.

NOR will it be difficult to deduce a knowledge from hence, concerning the event of an internal suppuration, in which no access can be given to the hand nor to other proper remedies, for many and great disorders (§ 406, 413.) with collections of matter in the cavities of the body, thence follow.

From

From all that has been hitherto said concerning abscesses and fistulæ, it is very evident, how difficult it must often be to cure internal suppurations, to which neither the eye can penetrate nor the hand reach. For the curative indications § 402. are equally necessary in the internal suppurations as external ones. But it is often impossible, or at least extremely difficult to perform what is called for by the indications, for neither can the crude humours be maturated or concocted, nor the adjacent parts be mollified or relaxed, by the use of softening cataplasms and fomentations, since there is no access given to the hand. It is also frequently quite impossible to derive the suppurating matter outward in these cases, so as to discharge it in the form of a laudable matter by an opening with a lancet; but being therefore corrupted and attenuated by heat and stagnation, it corrodes the adjacent parts, or else being absorbed by the patulent orifices of the veins, it infects the blood with a purulent cacochymia, whence follow all the disorders mentioned at § 406. But matter contained in an internal abscess being daily increased, will by its weight make new sinuses and passages, if it is not absorbed by the veins, till at length making a way through the internal membranes of the thorax or abdomen, it produces an empyema or a purulent ascites. And as the matter becomes more acrimonious and increased in quantity daily, it will corrupt the viscera, and destroy the patient with a slow marasmus attended with the greatest miseries.

S E C T. CCCCXVIII.

IF again the necessity or office of the affected part towards life and health be considered, the difficulty of the cure and the future consequence may be easily foreseen.

If

If we know what internal part of the body is injured by the suppuration, we may determine from physiology, what maladies are to be thence expected, and the more or less difficulty which will be met with in the cure. Thus for example, if the liver is suppurated, much danger from thence may be justly expected, since that is a viscus absolutely necessary to life and health, as the formation of bile which is so necessary to chylification is produced by that viscus. Therefore a jaundice, cachexy, dropsy, and many other disorders are to be feared; besides the substance of the liver is so friable and tender, that almost every part of it may by degrees be dissolved by the long confined acrid matter, whence a tabes hepatica, and a putrid colliquative flux follows, which soon destroy the patient. But if such an abscess should open and discharge its matter into the cavity of the abdomen, it will produce a purulent ascites, with the same pernicious effects. The open ulcer in the liver will then daily generate more matter, and all the viscera of the abdomen will be macerated in the same matter and corrupted in a short time. But if by good luck the matter contained in the abscess of the liver should make its way through the integuments of the abdomen outwards, even then the event will be doubtful. For if pure white matter is discharged the patient may recover; but if foul sordes appear, the patient will certainly perish, as Hippocrates^a observes. Therefore the hopes are dubious in such a case, though it is not absolutely desperate. But if an inflammation arising in the encephalon turns to a suppuration, and no vent is given to the matter, then it will be impossible to avoid a destruction of the tender fibres of these parts, which are absolutely necessary to life; and therefore there can be little hopes in such a case. There are indeed some rare histories of wounds in the head which demonstrate

^a In Coacis prænot. n^o 451. & Aphor. 45. Sect. 7.

that matter, ichor, blood, *etc.* have been discharged by ways not well known from anatomy, out of the cavity of the cranium, and the patient has by that means escaped a desperate case; but perhaps there is not one in a hundred who thus escapes. If again the vital viscera contained in the cavity of the thorax, the heart and lungs, are invaded with an abscess, it is sufficiently evident what fatal events are to be feared.

The End of VOL. III.

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